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China: The Impact of Climate Change to 2030
Geopolitical Implications

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China: The Impact of Climate Change to 2030

Geopolitical Implications

Prepared jointly by

CENTRA Technology, Inc., and Scitor Corporation

The National Intelligence Council sponsors workshops and research with nongovernmental experts to gain knowledge and insight and to sharpen debate on critical issues. The views expressed in this report do not reflect official US Government positions.

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Scope Note

Following the publication in 2008 of the National Intelligence Assessment, *National Security Implications of Global Climate Change to 2030*, the National Intelligence Council (NIC) embarked on a research effort to explore in greater detail the national security implications of climate change in six countries/regions of the world: India, China, Russia, North Africa, Mexico and the Caribbean, and Southeast Asia and the Pacific Island states. For each country/region we are adopting a three-phase approach.

- In the first phase, contracted research explored the latest scientific findings on the impact of climate change in the specific region/country. For China, the Phase I effort was published as a NIC Special Report: *China: Impact of Climate Change to 2030, A Commissioned Research Report* (NIC 2009-02, April 2009).
- In the second phase, a workshop or conference composed of experts from outside the Intelligence Community (IC) determined whether anticipated changes from the effects of climate change will force inter- and intra-state migrations, cause economic hardship, or result in increased social tensions or state instability within the country/region. This report is the result of the Phase II effort for China.
- In the final phase, the NIC Long-Range Analysis Unit (LRAU) will lead an IC effort to identify and summarize for the policy community the anticipated impact on US national security.

In April 2009, CENTRA Technology, Inc., convened a group of regional experts to explore the socio-political challenges, civil and key interest group responses, government responses, and regional and geopolitical implications of climate change on China through 2030. The group of outside experts consisted of social scientists, economists, and political scientists. Although the targeted time frame of the analysis was to 2030, the perceptions of decisionmakers in 2030 will be colored by expectations about the relative severity of climate changes projected later in the century. The participants accordingly considered climate impacts beyond 2030 where appropriate.

The Central Intelligence Agency's Office of the Chief Scientist, serving as the Executive Agent for the Director of National Intelligence, supported and funded the contract.

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Executive Summary

The National Intelligence Council-sponsored workshop entitled *Implications of Global Climate Change in China* on 3 April 2009 brought together a panel of experts¹ to consider the probable effects of climate change on China from a social, political, and economic perspective. The panelists judged that ***China has a robust capacity to handle the large-scale disruptions that probably will be caused by climate change and that China's trajectory of continued growth is likely to further increase its resilience through 2030. Beyond 2030 the ability for the state to respond is more problematic.***

- At present China ranks lower in resilience to climate change than Brazil, Turkey, and Mexico, but higher than India.
- China can adapt its administrative, planning, and resource allocation capabilities used for its fast-paced and successful development program to deal with climate change.
- China's development plan incorporates sustainability and posits a shift from energy-intensive heavy industry toward services and domestic consumption.
- In spite of state-imposed limitations, China's nongovernmental organizations and civil actors are increasingly capable and willing responders to climate change.

Climate change in China will nevertheless exacerbate a number of existing large-scale socio-political, economic, and environmental challenges.

- The combination of water scarcity, desertification, dust bowls, and shifting agricultural patterns appears likely to generate mass migration from China's northern and western margins into the heartlands of the east and south.
- China's cities and the non-agricultural sectors of China's economy will have to absorb millions of unskilled workers displaced from rural areas, resulting in higher unemployment, increased social tensions, and strain on infrastructure.
- Climatic pressure on agriculture and a move from staple crops probably will make China an important food importer.

In addition to domestic challenges, the trans-border impact of China's environmental problems could lead to increased political tensions, regional economic disruptions, and deterioration in the quality of life for hundreds of millions in the region.

- China may seek to assure its access to critical water and energy resources on its periphery either through economic means or the threat of force.
- Climate change may increase Chinese emigration into Russia, Mongolia, and other neighboring countries. China may face refugee inflows from Southeast Asia, North Korea, or other areas hard hit by climate change.
- China may divert water from the Himalayas to address its water and energy needs, putting downstream countries in South Asia and Southeast Asia at risk.

¹ The panel had expertise in political science, comparative world history, energy and climate practice, the Chinese economy, and sociology.

China's responses to climate change are likely to focus on large-scale solutions that significantly alter the environment.

- China undoubtedly will invest heavily in infrastructure projects to divert water to drier areas, control flooding, and address expanding urban needs.
- China is likely to accelerate market-based incentives for urbanization, migration, and business location decisions better adapted to climate change.
- Owing to the scale and inter-jurisdictional nature of climate change-induced challenges, the central government will be the primary responder, resulting in further centralization and the heightening of hierarchical controls.

China's response to climate change will nevertheless be inhibited by a number of structural, political, and economic factors.

- ***Panelists judged China's leaders consider sustained high rates of economic growth as essential for regime security, and they will not compromise these fundamental interests for the sake of climate change mitigation.***
- China will face drastic near-term rises in energy demand as its economy, industrial base, and standard of living increase.
- China will be forced to address energy demand primarily through domestically produced coal and imported oil, leading to a severe rise in China's contribution to global greenhouse gas emissions.

Climate change will create incentives for greater cooperation between China and other major powers as China increasingly assumes a leadership role in the international system.

- China's R&D and industrial development policies are increasingly focused on energy and environmental issues.
- ***Climate change is likely to increase China's overall dependence on international sources of energy, food, and technology.*** As a result, China probably will increase its presence and activity in international markets and resource-rich countries.

Despite a willingness to work with the United States when interests are aligned, China's attitude toward the United States is one of deep distrust. Securing China's commitment to a climate change agreement will require a multi-layered and nuanced diplomatic approach.

- China will face resource constraints and domestic destabilization that will limit its ability to make compromises with foreign partners or take aggressive mitigation actions.
- Engagement with Chinese academics, the bureaucracy, and civil actors will help disseminate foreign ideas in acceptable forms.
- China views India as a key strategic competitor and will feel threatened by any US attempt to strike a private climate agreement with India. On the other hand, China and India agree on issues of equity and responsibility for climate change and may cooperate against the developed countries' positions.

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Introduction and Background²

China is well known for its scale: it has the world's largest population, the third largest land area, and the fourth (nominal) or second (purchasing power parity) largest economy and is the second largest primary energy producer and consumer and the largest carbon dioxide emitter.

As a major global player in human-caused climate change, China is vulnerable to the adverse impacts of climate change:

- Over the past century (1908 to 2007), the average temperature in China has risen by 1.1 degrees Celsius (°C).
- Although no significant trend was observed in nationally averaged precipitation totals over the past 50 years, a drying trend was observed in the Yellow River Basin and North China Plain.
- Over the past 30 years, the sea level and sea surface temperature have increased 90 millimeters (mm) and 0.9°C, respectively.
- China has experienced more extreme events (floods, droughts, and storms) in recent years than ever before. These extreme weather events have caused direct economic losses per year of \$25 to 37.5 billion in China.

One regional climate model projects a country-averaged annual mean temperature increase of 1.3-2.1°C by 2020 (2.3-3.3°C by 2050); another regional climate model projects a 1-1.6°C temperature increment and a 3.3-3.7 percent precipitation increase between 2011 and 2020, depending on the emissions scenario.

By 2030, sea level rise along coastal areas could be 0.01-0.16 meters (m), increasing the possibility of flooding and intensified storm surges, leading to degradation of wetlands, mangroves, and coral reefs.

Agricultural growing seasons will lengthen and the risk of extreme heat episodes will increase over time. Storms may intensify, but warming temperatures are likely to enhance drying in already dry areas, so both droughts and floods may increase.

China ranks lower in resilience to climate change³ than Brazil, Turkey, and Mexico but higher than India. China ranks high in food security, human health, and human resources.

Projections of resilience show China gaining capacity quickly and outranking Brazil, Turkey, and Mexico by 2020.

In recent years, the Chinese Government has paid increasing attention to the negative consequences of climate change. In 2007, China laid out its roadmap to battle climate change in *China's National Climate Change Program (NCCP)*, which was followed by a white paper in 2008 entitled, *China's Actions and Policies on Climate Change*. Both documents reviewed China's past achievements and presented its plans in the following areas:

² This section is extracted from Executive Summary of the Phase I report (see Scope Note: http://www.dni.gov/nic/PDF_GIF_otherprod/climate_change/climate2030_china.pdf). Some of the judgments in this report (Phase II) may differ from the Phase I report.

³ See the Phase I report, p. 23, for a description and discussion of resilience.

- Strengthening government management in vulnerable sectors such as water resources, agriculture, forestry, and coastal regions.
- Building early-warning and monitoring networks.
- Raising public awareness.
- Enhancing R&D investment.
- Keeping an open and active attitude to utilize international resources.

China is demonstrating its determination to tackle climate change issues as an important domestic affair. However, some prominent climate impact issues—such as the underrated and underpublicized water crisis, as well as the underdeveloped social protection system—have seemingly not caught the government’s attention. In addition, China must show an ability to actually implement its ambitious plans.

The negative consequences of climate change may expose the following sectors to high risk:

Water. Scarcity of natural water resources, fast-growing urbanization and industrialization, severe water pollution, cheap water prices, and the adverse impacts of climate change on water sources might lead to a water crisis in China. The drought regions in northern China may be prone to social unrest caused by conflicts about water rights and distribution between social groups and between sectors. The expected South-to-North Water Diversion Project may alleviate the water stress of some northern regions, but it will not provide a full solution (and has in any case been delayed). The forthcoming water crisis may adversely affect China’s social, economic, and political stability.

Coastal Regions. Due to their flat and low landscape, China’s coastal regions, the heartland of China’s economic progress, are highly vulnerable to storm, flood, and sea level rise. The increasing frequency and intensity of extreme weather events such as typhoons has threatened economic development at local, regional, and national levels. China has been actively developing early warning systems and related monitoring systems, and improving the design standards of sea dikes and port docks. These efforts may help buffer some risk of natural weather extreme events.

Social and Political Uncertainties. With a large unemployed population, China’s underdeveloped social safety net system is less and less able to protect those who need it. Rising expenses in healthcare, education and housing have been financial burdens for the average Chinese family. The export-oriented economy is vulnerable to a global financial crisis. The increasing dependence on foreign oil exposes China to an unstable world oil market. The adverse impacts of climate change will add extra pressure to existing social and resource (such as energy) stresses.

Social, Political, and Economic Challenges

Climate change through 2030 is likely to subject China to severe ecological problems. It is not clear whether the resulting demands made on China will exceed the country's capacity to manage its economic, social, and political systems. If climate change-induced challenges occur gradually and can be forecasted and planned for accurately, China has the capacity to deal with them successfully. There are some grounds for optimism in the near term; the average trends underlying emerging climate change conditions in China imply only gradual adjustments. In addition, China's geographical location squarely astride the world's northern temperate zone appears to insulate the country from the more severe changes reportedly associated with coming global warming trends in tropical and arctic regions of the planet.

On the other hand, China already faces rising social tension over inequities and conflict over scarce resources, which will be magnified by unemployment from the current global economic slowdown and further exacerbated by near-term climate change trends. In addition, economic and social impacts are likely to come in bursts driven by major events such as a prolonged drought, a prolonged and especially heavy monsoon, a series of severe typhoons or dust storms, or an unusual sea surge causing a rush of increased coastal ground water salinity. There is a distinct risk of low probability, high consequence events in which a number of climate-related developments interact to produce negative synergies. Under such circumstances events could spin out of control, resulting in serious social and political crises.

When considering possible social, political, and economic challenges, it is worth noting that there are plenty of knowledge gaps in predicting the future effects of climate change. Currently, it is impossible to definitively model climate change, much less its impacts, in a useful time frame. In addition, the factors that affect water supply and productivity, the effects of dust clouds, and pests and agricultural diseases are poorly accounted for in current models. China's internal climate is very complex and varies across regions and at the local level. Social, political, and economic impacts, and by extension state capacity questions and societal responses, will exhibit substantial regional differences.

Hydrologic Challenges

China already faces an escalating water crisis brought on by increased water demands generated by expanding industry, urban populations, and agriculture. The impact of climate change on China's water resources will make this crisis considerably more severe, forcing large-scale mitigation measures to stave off the loss of arable land, disruption of agricultural patterns, and internal migration as many locations are rendered less habitable.

Over the longer term, phenomena such as glacial melting in the Himalayas, greater variability in the monsoons, and more frequent and intense storms will contribute to increasing irregularity of river flows, both from the watershed of the Himalayas and Tibetan Plateau and in the lowlands. In addition, rainfall will be more irregular, with episodes of drought punctuated by intense rainstorms. The total amount of rain received by particular regions will change, either increasing or decreasing as climate zones and weather patterns shift. This will place severe stress on farmers and agricultural systems dependent on traditional patterns of river flow and rainfall. Particularly in the case of regions still dependent on subsistence agriculture, this will generate environmental refugee flows and necessitate humanitarian intervention and reallocation of resources by the Chinese Government.

In addition, China will experience sustained shifts in water availability across large swaths of the country. Northern China will become drier. Southern China and south-central China, which already have substantial monsoon rains, will see even more precipitation as a result of climate change.

Water Scarcity, Droughts, and Floods. Sustained water scarcity is likely to occur across much of northern China, as well as more frequent and severe periodic droughts. These climate change impacts threaten a further deterioration of conditions already seriously affected by long-term water mismanagement, bringing costly damage or disruption to farms, non-farm businesses, and households. Climatic shifts will likely lead to southward and eastward encroachment by the Gobi Desert and severe water scarcity in the breadbasket of the North China Plain. Severe water shortages could generate broad stress across China's economy, population, and infrastructure. Scarcity will force increasingly difficult tradeoffs in water allocation between agriculture, industry, and population centers. Simultaneous population movements into China's cities will most likely restrict China's ability to divert water away from urban needs. China will therefore face the need to transition to less water-intensive farming and industrial techniques.

In the south and along China's coasts, the challenge will be overabundance rather than scarcity of water. The greatest impact will most likely come from more frequent and serious flooding, particularly in China's heavily populated river basins. Human tragedies and business losses resulting from flooding occur somewhere in China virtually every year, and these losses can be expected to increase substantially.

The North China Plain. The most disruptive impact of water scarcity in northern China may be felt in the North China Plain, the agricultural heartland of northern China. It is home to approximately 220 million people and encompasses the five provincial-level jurisdictions of Shanxi, Henan, Hebei, Beijing, and Tianjin. Although irrigated by the Yellow (Huang) River, water scarcity has forced the mining of groundwater, which is a nonrenewable and an unsustainable practice. There are already more than two million deep wells in the area, which combined with climate change will seriously deplete the water available to the region. The severity of population pressure on arid lands and declining water tables on the North China Plain was long kept a "state secret" starting in the mid-1980s to avoid alarming the populace. A sustained water crisis on the North China Plain would cause severe stress to both agriculture and the large rural and urban population, which may also be swelled up to 50 million environmental migrants and refugees fleeing desertification on the southern and eastern margins of the Gobi Desert.

Coastal Areas. Although China's coasts have plentiful access to water compared to the hinterland, climate change will put them at risk from sea level rise and storm surges, according to the Phase I report. New storm paths will open up northeastern coastal areas to tropical storm damage, putting places like Shanghai and Tianjin at risk. Rising sea levels will increase saltwater intrusion in coastal farmlands, contaminating the soil and groundwater with salt. In addition, there may be loss of wetlands and low-lying arable land. Given China's coastal topography, the predicted rise in sea levels of 0.4-to-6.3 inches by 2030 will only impact certain coastal reaches of northern Jiangsu, some islands in the Yangtze River, and scattered strips of land in delta areas along China's coast.⁴ Storm surges from more frequent coastal storms may pose a more significant threat of flooding in coastal delta areas. China's development patterns

⁴ See interactive maps in this regard at <http://flood.firetree.net>.

have placed large populations and major capital assets in these areas, so the human and economic impact of such flooding could be considerable even if the affected areas are geographically limited.

Agricultural Challenges

China's agricultural sector will face acute stress from climate change, particularly as a result of impacts on water availability and distribution. This stress will be unequally distributed, with certain regions denuded by drought and desertification while others actually experience gains in productivity as a result of longer growing seasons or increased rainfall. The overall direct effect of climate change on agricultural productivity in China is uncertain. Although some estimates suggest that overall productivity may decrease by 5 to 10 percent by 2030, this depends on the highly unlikely assumption of no mitigating responses by farmers or the state. Some decline in productivity is likely, but the uncertainty of both the degree of climatic stress on agriculture and the effectiveness of responses makes it very difficult to predict its extent.

Economic growth will fuel dietary demand for animal proteins, which will require cheap grain as feed. This will force China to either subsidize grain production or look to foreign sources. The major socio-economic effect on agriculture, rather than a sustained decline in productivity, may be a sector-wide reallocation of agricultural activity between regions and between types of crops. Such a reallocation would involve mass movements of rural populations, both into new agricultural regions and into urban areas; the adoption of new cultivation patterns and farming practices; vast changes in rural infrastructure; and major shifts in China's domestic and external agricultural markets. Whether they participate in such a shift or not, farmers will face pressures to increase profitability as farming is rendered more difficult by climatic and agronomic effects. High-value commercial farming and crop specialization are likely to result, causing production of less profitable staples to decline. These pressures will likely make China a much larger food importer than it has been to date.

Agricultural Labor Surplus. Despite the rapid industrialization and urbanization of the past three decades, the proportion of China's population engaged in agriculture remains far above optimal levels. Over 300 million people are engaged in agriculture for income reasons, where a workforce of 210 million would be able to produce the same amount of output. By shifting production to different crops China could theoretically reduce the agricultural workforce to 100 million for the same amount of caloric output. Climate change may also open up vast new farm belts in Siberia and Canada, making new foreign food sources available to China and further decreasing the necessity for a large rural labor force. A shift comparable to that in Japan, where agricultural employment dropped from 40 percent in the 1950s to seven to eight percent by the 1970s, is a possibility in China. Sustained economic growth has so far provided sufficient employment for laborers moving off the farms to keep the sectoral shift manageable. The number of unemployed workers in China is nevertheless in the tens of millions, and increased agricultural efficiencies, mechanization, and stress from climate change may generate an employment crisis.

Desertification and Dust Bowl Eruptions. Even if the overall impact on productivity can be successfully mitigated, some of China's key agricultural regions, such as the North China Plain, will face acute climate change-induced agricultural stresses, primarily from water scarcity and contamination, but also from extreme events such as dust bowl eruptions. Unsustainable practices such as overgrazing and cropping of marginal lands have been a serious problem in Inner Mongolia and other semi-arid parts of China for many decades. Combined with climate

change-induced water scarcity, these human impacts are exacerbating the spread of deserts and incidence of dust storms. The potential is increasing for dust bowls in northern and western China more serious than those in the central United States during the 1930s. As was the case in the United States, sustained dust storms would generate a mass exodus of environmental refugees from the affected areas as well as a severe and sustained decline in regional agricultural productivity. Depending on the timing of dust bowl eruptions and severe water shortages, these effects may be mutually reinforcing. Alternatively, water scarcity may preemptively move people and agricultural activity out of areas most at risk for dust bowl eruptions, mitigating their impact.

Pollution and Public Health Challenges

Industrial growth in China over the past several decades has caused major increases in pollution and environmental degradation. One of the challenges in addressing pollution is that much of it originates from aging, intensely-polluting industries in the poor interior of the country, where there are fewer resources available to move to cleaner technologies. On the one hand, climate change impacts may worsen the effects of some of this pollution and create mutually reinforcing stresses on the environment. On the other hand, climate change mitigation policies may also mitigate pollution and encourage China to move toward a greener economy.

Water Pollution. Industrial pollution of rivers and groundwater is a major problem in China, and climate change will make its effects worse. As climate change-induced water scarcity makes water a more precious resource, the need to keep China's water clean will increase. Flooding will bring large populations into contact with contaminated water. In addition, industrial water pollutants may enter the food chain as well as reduce soil fertility.

Air Quality and Aerosols. The special measures China had to take to improve air quality in Beijing for the 2008 Olympics highlight that China has per capita the world's worst polluted cities in terms of airborne particulates. It is a leading producer of pollutants such as carbon dioxide and sulfur dioxide which exacerbate climate change effects. The density of industrial aerosols will compound the effects of increased airborne dust produced by desertification and potential dust bowl eruptions. Urbanization intensified by climate change will put larger populations at risk from air pollution. Shifting rain and wind patterns may spread atmospheric pollutants over wider areas and contaminate already stressed ecosystems. Other countries in Asia, such as South Korea, have been able to make great strides in reducing air pollution, which China may be able to do as well. Paradoxically, some studies suggest airborne particulates may partially shield China from warming occurring at higher levels of the atmosphere. If so, reducing air pollution may intensify the predicted rise in air temperatures.

Public Health and Social Services. Climate change can be expected to place additional stress on China's already under-developed public health and social services systems. In the past 15 to 20 years, the availability of medical services, life expectancy, and the quality of natal care have increased. That said, China is still a roughly \$3,000 per capita GDP society where social safety nets are a luxury. Panelists judged that as per capita GDP climbs to \$15,000 per capita by 2030, coverage and cost of social safety nets will have improved significantly. However, progress to date has been unevenly distributed between rural and urban areas and remains inadequate in many regions across the country. Responsibility for social services has increasingly devolved from the central government to the regional or local level and Chinese citizens are required to pay an increasing share of the costs. Progress in expanding services has not kept pace with public expectations, creating a source of popular discontent. As a consequence of climate

change, public health and social services systems will have to bear the burden of major influxes of population into some areas while in others local revenue bases, such as from agriculture, may dry up.

Demographic Challenges

Urbanization. Urbanization is one of the most important demographic trends in China right now. Rapid urban growth is creating a major strain on China's urban infrastructures, which will also be stressed by climate change. Such stress takes the form of urban expansion into rural areas, growth in size of cities and towns, and most significantly a major population shift from rural to urban areas. Urban areas might be faced with a mass influx of environmental refugees as a result of climate change. This movement might be too rapid for urban areas to absorb, particularly if refugees elect to stay in the cities permanently. One of the most critical issues is urban access to water. The water scarcity expected in northern China impacts the water needs of urban populations as much as it does those of agriculture or industry. Cities without water are a problem on an entirely different scale than crops without water, particularly if water availability declines rapidly or changes sporadically. The problem is compounded by the patterns of urban growth. Urban growth has been distributed throughout the more populated parts of the country as county seats expand into cities. Much of the expansion has therefore taken place in inland areas with inadequate water resources.

Urban expansion can follow a pattern like Tokyo—high density and high efficiency—or like Houston—a low efficiency sprawl. The way resources are priced has led China's cities to match the Houston model. Every square meter per person in housing increases the per capita amount of building materials. The average building in Beijing requires 70 kilograms of building materials per square meter. If China's urbanization follows a low density trajectory, it will therefore eat up a great deal more steel, cement, and other materials, which in turn will require more water and power usage to produce them. Such a pattern of urban growth will exacerbate climate change-induced stresses on resource availability.

Many of the people moving to the cities for work are younger Chinese. They have tended to send remittances back home, which helps to mitigate the problem of the labor force moving, while providing support to older relatives still on the farm. This is changing as rural transplants become more settled in urban life and ties to the rural areas become weaker. Combined with the aging population, this reduction in familial support places a greater burden on the state to provide for the elderly.

In addition, there is a deep rural-urban, socio-cultural divide in China, with urban populations tending to perceive rural migrants as backward and inferior. Urban residents and officials also tend to disregard the resource needs of rural areas, which is significant given the cultural and demographic shift of the Chinese Communist Party (CCP) toward urban members. Residents of Shanghai, for example, tend to see environmental and resource problems in Anhui as none of their concern. As climate change places urban and rural cultural groups in proximity and forces greater resource allocation to rural areas, social tensions and prejudices are likely to increase.

In addition to urbanization, China will face a number of other demographic challenges over the next two decades and beyond. Although the direct impacts of climate change on these phenomena may be minor, they will place additional stresses on China's resources and compete for resources that might otherwise be allocated to climate change.

Aging of the Population. China's population control policies over the last several decades, notably the one child policy adopted in 1979, have skewed the country's demographics, resulting in a rapidly aging population. Over 400 million Chinese citizens of the so-called 'aging cohort' born before the one child policy are at or are soon to reach an age where they will no longer be economically productive. China lacks a state social security system or an adequate overall healthcare system to support them. China's Confucian ethics make it the filial responsibility of children to support their elderly parents and grandparents, but this traditional system of familial support has broken down. The growing mobility of the population and the trend toward urbanization have led younger Chinese to move away from their parents. In addition, the one child policy has led to the 'four-two-one problem:' a single worker will have to support two parents and four grandparents. The latter problem is a major roadblock to the adoption of a system like that in Singapore legally obligating children to be responsible for their parents. Whether the state institutes a social security system to take care of the elderly or the responsibility falls to their offspring, the demographic imbalance will produce a major transfer of resources from the working to the nonworking segments of the population. This could become a major problem on China's growth potential as it will need more resources to expend on elderly care and climate change-induced challenges. On the other hand, the increased need for healthcare and workers in social services to care for elderly may offer a new source of service employment.

Gender Imbalance. Due to Chinese cultural and economic preferences for male offspring, the one child policy also has resulted in a gender disparity in the population. There are significantly more male Chinese than female in the post-one child policy generations. This male-female imbalance will further restrict the potential size of future generations. In addition, it will leave large numbers of males without mates, generating a pool of unsettled manpower that could potentially be mobilized to threaten public order. These men are also a demographic likely to be disproportionately involved in climate change-induced shifts such as migrations and changes in employment patterns.

Economic and Industrial Challenges

Climate change almost certainly will have a significant impact on China's continued economic growth, but the magnitude of that effect is uncertain. China's economic resilience to climate change will be contingent on the manner and effectiveness of the country's responses both to climate change-induced challenges and structural transformation of its evolving economy. China has undergone several decades of rapid economic growth, and current projections indicate that China will be or will almost be the largest economy in the world by 2030. Although China's economic development model has produced spectacular economic growth, it has had a number of unfortunate by-products of which environmental damage has been a prominent one. Environmental constraints, either local or global, may nevertheless significantly hamper China from reaching its long-term growth targets. Climatic pressures increasingly will play into Chinese economic decisionmaking and may force or accelerate a change in China's economic behavior. Even absent climate change-induced impacts on the economy, export-led growth has reached a point of diminishing returns. China needs to transition away from its investment-driven export-led economic model to one driven more by domestic consumption and services. In addition, panelists judged China will need to master a series of new technologies, including information technology and nanotechnology if it is to continue their economic success to 2030 and beyond. This change in China's growth model could produce more political contention and strife, with adverse consequences for the environment.

Energy Challenges. China already faces drastic near-term rises in energy demand as its economy, industrial base, and standard of living expand. The country has transitioned from two decades of energy demand rising slower than economic growth to the past seven years of energy demand exceeding economic growth. China's economic growth has become increasingly energy intensive as heavy industry plays a leading role in the economy. The dynamic of increasing energy demand is likely to accelerate over the next two decades, exacerbated by increased climate change-induced urbanization and infrastructure demands. As a result, China will have little room to maneuver in terms of limiting energy production for the sake of climate change mitigation.

China has little option but to address energy demand primarily through domestically produced coal and imported oil, which will lead to a severe rise in China's contribution to global greenhouse gas emissions. In addition, if China's economy continues to grow in an energy-intensive manner, it will produce an unsustainable strain on global energy resources. Energy-intensive development also generates suboptimal employment growth. For example, the five most profitable industries in China use half of its energy and produce half of its carbon dioxide but only employ 14 million people. China will therefore face increasing pressure from economic and social as well as climate change standpoints to transition to a less energy-intensive, service-oriented economic model. In addition, there is substantial room to increase the efficiency of China's industrial plant, which is largely old and energy-intensive.

Employment Challenges. Climate change is likely to significantly exacerbate the challenge of creating jobs for China's workforce. China's labor market is in the midst of a multi-stage transition from agriculture to light export-oriented industry to heavy industry to services and domestic consumer products. This complex process dictates that a large proportion of workers are in flux between jobs or between economic sectors.

The types of jobs and skills that are in demand are evolving. Simply being an able-bodied worker will no longer guarantee someone a job. Although in part employment has shifted toward skilled industrial labor, a large part of the shift has been toward new areas of semi-skilled and unskilled employment such as services and construction. The service sector is a ripe area for job creation that can be expected to boom as standards of living increase. Although the service sector requires a new and unfamiliar skill set to rural migrant laborers, the rest can be learned through on-the-job training provided that workers have basic literacy. Compulsory education is expanding to rural areas, providing a foundation that will make it easier for those leaving the countryside to find work. In the medium-term there also will be almost unlimited job opportunities in the construction industry, although many workers regard construction work as too hard. Not only is the economy expanding, and with it a need for more structures of all sorts, but older, poorly made structures are deteriorating and need to be replaced.

In the past the Chinese industrial sector could rapidly take in large numbers of unskilled workers for tasks that do not require a high degree of training. This capacity has declined as growth in the low-skilled labor-intensive export sector has slowed, leading China's labor market to underperform over the past five years. Some of the shortfall in unskilled employment will be offset as rising standards of living expand domestic demand for consumer goods, allowing light export industries to re-orient to serve the domestic market. Climatic stresses will likely prompt the expansion in areas such as healthcare and social services, providing employment in those sectors. The state focus on climate change and environmental initiatives also could bring "green" jobs into the economy in significant numbers.

China's high rate of growth in the last three decades has kept employment levels high even as the nature of the labor market has changed rapidly. Official unemployment estimates tend to hover in the 4.0-4.5 percent range, although actual unemployment may be closer to 9.5 percent. Assuming the continuation of current trends, China's economy would likely be able to continue to accommodate the shifting pool of labor. That may not be the case when the effects of climate change are factored in. Climate change pressures will increase internal migration and disrupt traditional modes of employment, particularly in rural areas. This will significantly intensify the large influx of unskilled rural labor into the urban and industrial labor markets driven mostly by desperation rather than employment opportunities. As a result, major discontinuities could occur between demand for jobs and demand for labor, which could drive China's unemployment rate much higher and generate severe socio-economic tensions.

Political Challenges

Climate change is likely to exacerbate the major political dilemmas that China will face over the next two decades. The world currently sees China becoming more successful under authoritarian rule than some democracies. As China struggles to respond to climate change-induced challenges, the flaws in China's political system probably will become increasingly apparent to China's population, the government itself, and the world at large. In the longer term, China's party-state regime faces a need to increase its responsiveness and accountability to the public or risk losing its already questionable legitimacy. Increased public responsiveness need not imply democratization. The idea of "consent of the governed" resonates more with Chinese citizens than the word "democracy." The Chinese do not demand the form and structure of a democracy to ensure that the government operates with their consent. Democratic elections are one way to give the public influence over public policy, but are not always an effective mechanism in the face of entrenched elite interests. Elections provide a safety valve for public dissatisfaction that is not available in an authoritarian system, but there may be other ways for citizens to vent stresses that may be exacerbated by climate change.

Panelists observed that according to the published government statements, the Chinese government has no intention of allowing broad-based democratization to replace its monopoly on power. Nevertheless, the government recognizes that some form of governance reform and greater public say will be necessary to avoid a crisis of legitimacy in the longer term. The precise form it will take remains unclear. Through the Institute of Policy Studies at the Chinese Academy of Social Science, the regime is seeking to determine whether a government can receive the benefits of democracy without becoming a democracy. For example, can the government receive citizen feedback without accountability if it does not comply or respond to the wishes of its citizens? The Chinese Government wants citizens to provide input and vent their frustrations but wants to retain a monopoly on policy decisionmaking. For example, NGOs or the Internet could provide alternative channels to receive feedback without direct accountability or elections. On the other hand, strengthening such mechanisms could create other challenges to the regime. China's senior leadership has conducted seminars in which civil experts are allowed to lecture without interruption, allowing greater freedom to express unorthodox views. There also have been experiments with limited democratic elections of junior party-state officials at the local level and in rural areas.

The debate within the leadership concerns the pace and scope of political reforms. The added challenges of climate change will strengthen the political hand of those in China and especially within the Chinese Communist Party. Arguably, too rapid movement in the direction of

democratic reform and economic liberalization would jeopardize the stability and rapid decisionmaking capabilities that Chinese officials believe are at the heart of effective climate-change adaptation. Climate change-induced pressures could therefore considerably delay government-driven political reform in China, particularly if challenges prove intractable or long-lasting.

On the other hand, climate change will most likely significantly increase political instability, as well as provide disaffected groups with a ready-made set of issues around which to mobilize. Climate change may therefore raise the prospects of a political challenge from below. Chinese political history is punctuated by often violent instability in the face of hardships when there is a sense that a fundamental social contract between state and society has been violated. The repressive capabilities of the Chinese state are considerable, and the prospects of a violent overthrow of the regime as a result of climate change are very remote. In addition, significant political change in China is unlikely in the absence of any credible political organization being offered as an alternative to the CCP. Nevertheless, a “populist revolt” could bring about a relatively peaceful political transition to post-communist rule by 2030 or beyond. Despite temporary disturbances at the time, the removal of the monopoly party-state’s limits on private enterprise and throttlehold on civil society would likely enhance state capacity to cooperate with business, civic organizations, and international entities to address climate change challenges.

Civil and Key Interest Group Responses

State Corporatism

Although China has come a long way from the totalitarianism of the Mao era, the presence and influence of the party-state apparatus remains pervasive. Nevertheless, the groups and institutions that comprise civil society in more open political systems are relatively abundant and well-organized. The vast majority exist under the auspices and supervision of the state rather than as autonomous actors, however. The party-state assigns officials and social leaders to run state monopoly associations for sensitive social groups such as industrial labor, villagers, women, youth, non-party professionals in various fields, business executives, and ethnic and religious groups. Prominent examples include the Communist Youth League, All-China Federation of Trade Unions, and All-China Women’s Federation. In addition, government ministries, state-owned enterprises, and sectoral bureaucracies have their own social institutions, including schools, hospitals, research centers, and museums. The bulk of civil society in China is therefore not strictly distinct from the state. It comprises what can be termed a “quasi-state,” with varying degrees of practical autonomy and influence but with groups ultimately responsible to the party-state. This system of “state-managed civil society” is known as state corporatism.

The socio-political space allowed for autonomous civil society is small and tightly bounded. Even most civil groups that did not originate within the state or party systems forge strong links with the party-state at various levels to act effectively and escape official persecution. Those that do not do so find themselves marginalized or even outlawed. The party-state regards independent civil actors with deep suspicion, even when they provide services the regime finds useful. The regime fears that legitimating societal mobilization could be the beginning of the end for the monopoly of unaccountable power held by the CCP, the maintenance of which is the regime’s number one priority. Issue advocacy and even criticism of particular officials or policies may nonetheless be tolerated, as long as it is limited in scope and does not call into question the broader legitimacy or actions of the party-state system.

There are some advantages to the state corporatist system, including the ability to quickly raise public awareness of issues. The party-state has ready access to broad-based and compliant civil organizations that can be used to disseminate the state's agenda on climate change and other issues to the public. Examples include the campaigns to publicize the White Papers of Agenda 21 on sustainable development in 1994 and on climate change policies and actions in 2008. In addition, although the civil actors that make up China's quasi-state are inhibited from most forms of autonomous advocacy, their links to the state provide an alternative avenue through which to exert influence on state decisionmaking, particularly at the local level. The basic system of monopolies is nevertheless under pressure from the reality of an increasingly pluralistic society.

Social Resilience

The financial, human, and environmental resources that China's society can bring to bear will, to a significant extent, affect the management of the consequences of climate change. A robust civil society committed to reversing the causes and addressing the effects of climate change may be crucial for success. Chinese environmental history is filled with instances of severe environmental challenges and responses from both state and society. This history shows a remarkable capacity in China for responding to environmental challenges, which the public response to the May 2008 earthquake in Sichuan demonstrated. The public at large, as well as previously marginalized NGOs and civil groups, stepped up to participate in the relief. The earthquake may prove to be a turning point for public awareness of China's environmental challenges.

China's history also reveals weaknesses in environmental stewardship resulting from bureaucratic corruption, aversion to risk, and self-gratifying social behavior. However, the greatest hindrances to an effective civil response to climate change-induced challenges are the limitations on autonomous societal action by the CCP-dominated state regime. The state may well preclude civil society from effectively responding to climate change.

Overall Social Responses

Migration. China can expect a number of cross-cutting broad-based civil responses to the kinds of pressures and challenges climate change will bring. Mass migration is probably the most daunting of these. Internal migration for economic reasons already represents one of the principal challenges to China's economy and social stability. It has primarily taken the form of rural migration into urban areas, but also of migration of laborers between urban areas. The combination of water scarcity, desertification, possible dust bowls, and shifting agricultural patterns appears likely to generate a massive migration from China's northern and western margins into the heartlands of the east and south. This will pose important resettlement challenges for national and local governments in China. The most likely destination areas already have very high population densities, both rural and urban. Although the broad pattern of population movement can be predicted, specific climatic crises may generate large-scale, rapid migration of refugees, the sources and destinations of which are not easily predictable. Such rapid migration could pose the most serious challenge to China's stability.

Anti-Government Protests. Despite state repression, protests are a growing phenomenon in China. If more extreme climate events occur, tensions between civil society and the government might increase. The environment has been a rallying point for civil advocacy and protest, and perceived government failures to adequately respond to the impacts of climate change will most likely generate wide-scale public responses or demonstrations. In the wake of the Sichuan earthquake parents of the children killed in the quake went to court to prosecute the officials who

built the shoddy schools and lined their pockets with the leftover money. China's courts and other administrative infrastructure are not designed to accommodate public grievances directed at the state but may face such issues more frequently in the future.

The obvious natural causes of many localized climate change-induced events such as floods or droughts may blunt the political anger that might otherwise be directed at the government, as long as the government is seen as responding adequately to disaster conditions and has shown preparedness for such events. On the other hand, protests may move from mild, non-violent advocacy to rioting and even uprisings if the public perceives that climate-change-related policies are unfair or ineffective. If emergency assistance is inadequate, social unrest and attacks on local governments and the CCP will surely erupt. Charges of corruption, in the form of embezzlement of funds initially targeted for climate change mitigation, also will be a rallying cry for protesters. The Chinese Government has considerable experience in responding to protests, but the state tendency to respond with arrests and repression to public criticism of the government may escalate matters as groups increasingly feel that their legitimate grievances are being suppressed.

Philanthropy. Based on its responsiveness to other crises, China's population probably will respond to greater stresses and more frequent natural disasters with increases in charitable giving. The Sichuan earthquake was a recent example of the Chinese willingness to donate and volunteer through private as well as state channels. Philanthropy in China is pervasive. For example, instead of waiting for government response, Chinese citizens filled their cars with supplies and headed to the site. Charitable giving on an individual basis is not regarded as threatening by the party-state as such activities by organized NGOs. Although such individuals cannot influence processes at the national level, over time they will gain the ability to influence processes of local government.

Socio-Economic Interest Groups

Rural Society & Rural Interests. Rural interests will be among those hardest hit by climate change-induced challenges. Farmers, herders, and village-dwellers are already under stress from socio-economic shifts that threaten the rural way of life. Over the next 20 years they will face both more frequent and more severe climate-related crises as well as sustained climatic shifts that will force them to adapt or relocate.

The primary interface between China's rural population and the state is at the level of village governance. Rural interests are not well represented at higher levels of government. Unlike under Mao, China's current rulers have a distinctly urban focus. On the one hand, this limits the advocacy potential of rural interest groups. On the other hand, the central government is willing to allow greater freedom of action in forming local associations and even sanctioned experiments in local democratization in rural areas. The demands of responding to climate change-induced challenges will necessitate much greater attention to rural areas by the state. Although this will bring an increase in resource allocation to rural issues, it also will bring greater scrutiny and likely a reduction in state tolerance for rural political experimentation.

The overall response of farmers and herders to climate change will depend to a large extent on what mitigation policies the state puts in place. The large size of the rural population and the endemic corruption, incompetence, and resource deficiencies of the government at the village and township level will hamper the pace and effectiveness of mitigation policy implementation.

Unless the state is able to adopt proactive mitigation policies and successfully implement them, local farmers and herders will by default be the first responders to rural climatic stresses.

Although many projections of climate change impacts on agriculture assume negligible adaptation by farmers, substantial technical evolution and innovation is occurring in China's farming households. The state corporatist system is effective at rapidly raising public issue awareness. If information about climate change is widely disseminated, farmers are likely to take proactive mitigation measures. The nature and effectiveness of such measures and their impact on agricultural productivity cannot be accurately predicted. In addition, state interests in maintaining high levels of production of cheap grain for the cities and military may conflict with farmers' interests in switching to more viable crops. In such cases, the state is likely to veto optimal agricultural responses to climate change.

Although some farmers may develop effective adaptations to climate change, others may respond to local agricultural stress by turning to unsustainable practices or competing, possibly violently, for resources with their neighbors. The role of the state and possibly NGOs in disseminating best practices for agricultural adaptation will be a crucial factor in mitigating such problems.

The predominant rural reaction to climatic stress is likely to be increased migration, both into urban areas and into more productive rural areas. Rural households will likely accelerate outmigration and consolidate farms in drought-prone regions. Inter-rural migration is likely to result in a more concentrated rural population with increased resource competition and rural conflict. This concentration of human pressure will likely affect the spread of climate change-induced challenges even into areas that suffer less direct climatic stress. In addition, as younger members of rural populations migrate to urban centers of modern employment, those left behind will be less able to cope with agricultural stresses.

Herding populations in China tend to occupy marginal land such as the steppe surrounding the Gobi Desert that will be especially at risk from climate change impacts. Animal husbandry practitioners will have greater incentives to adopt mitigation measures as standards for responsible rangeland management appear more affordable. Herding populations are even more likely than farmers to respond to climate change through migration. This will reduce the number of ruminant animals on marginal land, but increase their concentration in better-resourced areas, increasing the possibility of violence between farmers and herders. The possibility for conflict is intensified by the fact that many herders belong to ethnic minorities such as Mongolians while farmers are more likely to be Han.

Urban Interests and the Middle Class. Although China's per capita GDP remains far below levels in most developed countries, economic growth has nevertheless produced a sizable and growing middle class. Particularly in the wealthy coastal cities such as Shanghai, the standard of living of the urban middle class affords access to lifestyle luxuries rather than just necessities. This also results in dietary changes which include a demand for more meat. As is the case in many developed countries, the desire to live in a cleaner, more sustainable environment is one of the ways in which this lifestyle freedom manifests itself. China's urban middle class will likely follow the same pattern previously seen in developing Japan and South Korea, where economic growth brings the willingness and money to pay for cleaner energy and a cleaner environment. As climate change-induced challenges become increasingly prominent, the middle class may become an important source of resources to bolster China's responses and mitigation measures.

China's cities have become complex conglomerations of established urban families, formerly rural families who have settled in the cities, and migrant laborers who move from city to city seeking jobs. This mixture can be volatile, placing stress on employment and the rural-urban cultural divide. On the other hand, more urban residents originate from rural families than from urban families and this will only increase due to climate change. Over time this shift should help mitigate rural-urban cultural incompatibilities as rural people acclimate themselves to urban living and a hybrid urban culture develops. The timing of such a cultural reconciliation relative to when the cities will be hit by severe climatic challenges will play a large part in determining the level of urban instability and cultural conflict China will face.

Urban inhabitants are less likely to respond to climate change with migration than people living in the rural areas. There is no economic or climatic incentive for urban dwellers to move to rural areas. Without an option to displace urban stresses through migration, cities are likely to experience greater levels of socio-economic conflict, rioting, crime, and anti-government protests.

Business & Industrial Interests. China's economic development has created a large and rapidly expanding set of private and semi-private business interests, spread across many sectors including the energy industry, heavy industry, high technology, environmental goods and services, service sector industries, and others. The emergence of distinct interest group identities within the private sector has been slow, and those identities in many cases remain latent. The challenges and possibly new opportunities generated by climate change may sharpen conflicts among different economic interests and facilitate cooperation between those facing similar issues. This is already accelerating the mobilization of latent identities into full-fledged commercial and industrial interest groups.

As with other civil groups, business is closely tied to the state. Businesses are not independent entities that lobby the government, but their ability to influence state policy is nevertheless considerable. State-business ties operate on two primary tracks. Industries are overseen by state officials and ministries responsible for their sector of the economy. This ensures industries have a constituency within the government and receive allocation of state resources and planning attention. In many cases the same leaders act as sectoral officials and commercial executives. In addition, there is a well-established patronage system through which businesses cultivate personal ties with state officials. Family members of power-holders pervade the world of business. Unofficial networks of well-connected families are de facto a very powerful set of lobbies that have had a major influence on state policy in areas relevant to climate change.

The influence of business and industrial interests—both official and unofficial—has so far worked against effective state responses to climate change-induced challenges. Commercial interests lead the effort to make money no matter the environmental impact. Entrenched quasi-state groups that control the most polluting heavy industries have colluded with leading families tied to the energy industry to forestall environmental regulation and ensure China continues to build polluting power plants. When government reformers tried to create an 'energy czar' so that China could manage both its energy needs and its environmental imperatives, such groups undermined the effort. Even state-owned enterprises such as China National Petroleum Company (CNPC) have learned to manipulate the state for their own profit. Similarly, networks enriched by the energy industry have blocked state efforts to reduce China's National Oil Enterprises' ties to the Government of Sudan, even though China receives little of the oil produced and much international criticism. In addition, access to foreign funding increasingly

has allowed private businesses to take autonomous positions vis-à-vis the state. The capacity of China's state apparatus to effectively respond to climate change may be significantly hampered by profit-seeking business and industrial groups.

Ethnic Minorities

Ethnic minorities make up only about eight percent of China's population, which represents in excess of 100 million people with nine groups comprising over five million members.⁵ In many cases, such as with Islam or Tibetan Buddhism, religious divisions occur along ethnic lines. Ethnic minorities are concentrated mainly on China's periphery, many in areas that will face serious climatic challenges such as water scarcity, flooding, and desertification. Particularly acute climatic stress on regions where minorities are concentrated may be translated into ethnic unrest if the state is slow to respond or the Han majority is seen as receiving disproportionate assistance. In addition, minorities may increasingly migrate into traditionally Han-dominated areas, raising the potential for ethnic strife. The most sensitive issues are likely to involve groups already in conflict with the central government, notably China's Tibetan and Uighur populations.

Xinjiang and the Uighur: Numbering over eight million, the Uighur are a Muslim Turkic people residing in Xinjiang in China's arid west. The Uighur are closely related to populations in the former Soviet Central Asian countries and historically regard Xinjiang as "East Turkestan" rather than western China. They have carried out a protracted ethnic and religious-based separatist campaign, including acts of terrorist violence. The conflict has been worsened by China's "Develop the West" policy encouraging migration of Han Chinese into Xinjiang. Xinjiang is mainly desert, with water, grazing land, and population concentrated in only a few areas. Han-sponsored development efforts have already put considerable stresses on water and other resources, and climate change-induced water scarcity and desertification could intensify violent Han-Uighur conflict and lead to a regional crisis if not effectively addressed.

Tibet and the Tibetans. Over five million Tibetans reside in Tibet and neighboring provinces such as Qinghai and Sichuan. Despite the high-profile international campaign for Tibetan independence, the Chinese Government has made progress in forcibly assimilating Tibetans by emphasizing economic and technical development while suppressing traditional cultural and religious practices. As in Xinjiang, large numbers of Han Chinese also have been encouraged to migrate into Tibet, reducing native Tibetans to an underclass. Those Tibetans clinging to traditional ways of life in rural areas will suffer disproportionately from the environmental impacts of climate change on Tibet as well as from ongoing economic development and resource exploitation. This will likely lead to accelerated assimilation as more Tibetans are forced into urban living and dependency on state largess as well as increased Tibetan-Han tensions.

Religious Groups

Religious groups have a growing presence in Chinese society after years of suppression and enforced marginal status. For the majority of China's population, scientific atheism remains an unstated orthodoxy supported by the state. This orthodoxy is nevertheless tinged with quasi-religious Chinese cultural practices incorporating elements of Taoism, Buddhism, and Confucian philosophy. More explicit forms of folk religion are quietly making a comeback along with adherence to non-indigenous religions such as Christianity. With the prominent exception of Tibetan Buddhism, the Chinese Government tends to be more tolerant of religious practices

⁵ The Zhuang, Manchu, Hui, Miao, Uighur, Tujia, Yi, Mongolians, and Tibetans.

among ethnic minorities, whose religion is seen as part of their culture. In contrast, the party-state has tended to view Christianity as particularly threatening because it is not primarily confined to marginal minorities, as is the case with Islam. The officially sanctioned Protestant association has 20 million members, but there are also a large number of underground or unregistered churches.

Religious groups still suffer broad official discrimination but local governments, with less central support and increasing responsibilities, are tapping into traditional religious interest groups for humanitarian work in providing social services such as education and disaster relief. For example, unregistered Protestant Christian churches and nonprofits, both domestic and international, were among the first and most effective responders to the May 2008 earthquake in Sichuan. Central authorities banned media coverage of their contributions, but local authorities have gained a new appreciation for what they can offer. In addition, religious leaders have increasingly taken on community leadership roles, whether in the village or urban neighborhoods. Religious groups and religious-based nonprofits have the potential to become an important social support structure and response mechanism to climate change-induced challenges. The extent to which the party-state will allow them to assume such a role remains to be seen, given that they could also become focal points for organized dissatisfaction with the regime and its policies.

Nongovernmental Organizations

As China's socio-economic system has become increasingly pluralistic, there has been a tremendous proliferation of civil non-profits. Domestic and international non-governmental organizations involved in charity, poverty alleviation and development, and environmental protection have been prime beneficiaries of state permissiveness since the mid-1990s. Boundaries on NGO activities will likely continue to loosen in the future. NGOs are in many cases better suited than the state to address climate change-induced challenges at the grassroots level. They might therefore end up institutional "winners" as a consequence of the climate changes that are hypothesized over the next twenty years. As with other civil actors, the extent to which NGOs will develop into effective institutions depends on what the state permits them to do. This in turn will depend on the policy "frames" that they adopt. NGOs will need to frame and publicize their issues in terms that generate policy legitimacy and governmental allies. One such avenue, used successfully on tobacco legislation, is to partner with members of the National People's Congress, which can publicly demand and disseminate issue reports from responsible agencies of the central government. In any case, the institutional constraints faced by NGOs will ensure that the majority have little influence on opinion or policy. The minority who have influence may profoundly impact how China is able to deal with climate change.

Government-Organized NGOs. State corporatism, unlike socialism, does not require that the state be the sole purveyor of civic organization. Nonstate groups are tolerated as long as they are ultimately subject to state oversight and authority. In order to facilitate this, Government Organized NGOs (GONGOs) are an integral feature of the state corporatist system. Created and organized under state auspices, GONGOs are often set up as officially sanctioned monopolists of civic activity in particular sectors. In both intent and practice, GONGOs often crowd out the development of independent NGOs. GONGOs are the only domestic NGOs allowed to operate at the national level, but their activities are strictly limited to their functional identity. GONGOs responsible to the Ministry of Civil Affairs, for example, are to contribute to poverty relief rather than addressing climate change.

China's GONGOs vary widely in their degrees of practical autonomy and legitimacy. Some GONGOs, such as the China Charities Federation or China Christian Council, are sham associations run by elderly retired bureaucrats or by loyal party members or followers. These sorts of GONGOs are largely discredited in the eyes of their involuntary constituencies and their attempts to promote disaster relief or environmental protection are viewed with skepticism. Other GONGOs have made efforts to improve their accountability, autonomy, management practices, staff structure and training, and organizational culture, often to obtain foreign funding and support as state funding is cut. Examples include CAST, the official association for science and technology professionals headed by Deng Xiaoping's daughter, Deng Nan, as well as the China Youth Development Foundation, headed by Hu Jintao associates from the Communist Youth League.

GONGOs are likely to become a primary vehicle through which the party-state disseminates and promotes climate change-related policies. GONGOs can be used to mobilize social responses and resources in a way that is controlled and not threatening to the authority of the party-state. To perform a large-scale mobilization role effectively, however, GONGOs will have to boost their public credibility, legitimacy, and flexibility in defining their missions more broadly. Such reforms are likely to increase their de facto autonomy and result in a convergence between GONGOs and independent domestic and international NGOs.

State Limitations on NGOs. Domestic NGOs operating outside the GONGO realm are constrained due to regime paranoia that they will become competitors to the party-state. Even at the local level the party-state is more concerned with the potential threat from NGOs than the ability of NGOs to solve issues. The state therefore raises major bureaucratic obstacles to NGO development and activities, which NGOs have devised ways to circumvent.

NGOs are required to register with the state, but the state makes it difficult to do so. In addition, NGOs—with the exception of the Red Cross—are banned from raising funds domestically. NGOs are often established through family money, but as their size increases they rely on foreign funding. In contrast, the growth of private enterprise is encouraged. As a result, NGOs often register as businesses to avoid bureaucratic red tape, which consequently obscures the actual number of NGOs operating in China.

The scope and scale of NGOs are strictly limited. The state discourages them from addressing multiple issue areas and they are prohibited from cooperating with each other. The government prohibits national NGOs except a handful of GONGOs and limits NGOs from growing too large or crossing administrative boundaries. NGOs have in some limited cases responded to official constraints on scale by proliferating downward—splitting off local and provincial-level branches from larger GONGOs.

NGOs are vulnerable to shifts in government tolerance. Protest, even of violations of the government's own rules, may lead to repression and/or imprisonment by the Chinese Government. NGOs that become too successful may find their employees arrested or disappear. NGOs have the best chance of surviving this precarious situation if they are fully transparent to the state. Their most important points of contact in the local government may be the secret police whom the NGO cultivates and keeps fully informed.

Large-scale challenges such as climate change or the global economic downturn highlight the Chinese state's need for the input of private resources to address them. The state was forced to allow unprecedented private involvement in the massive relief and rebuilding following the 2008

Sichuan earthquake. NGOs might also be used to address other policy goals, such as providing a low-risk venue for citizen feedback to the government. As a result, a renewed attempt to provide a regulatory framework and policy environment conducive to growing rather than restraining the nonprofit sector is likely.

Environmental NGOs. NGOs may have greater opportunities to play a constructive role in meeting climatic challenges than the daunting state-imposed limitations would suggest. The Chinese Government has been particularly tolerant of NGO activity on environmental issues. The government is well aware that the country needs the help of environmentalists, domestic and international, to control and limit the causes of climate change. The government, particularly the Environmental Protection Agency, has therefore been willing to encourage and ally with at least some independent environmental NGOs. Recognizing that local corruption and inefficiency often hamper environmental protection, the state has used NGOs as a mechanism for improving policy implementation.

Because of this permissive state attitude, NGOs are perhaps more effective in environmental protection than in any other area. At the local level, social and ecological movements have been allowed to protest and even achieve reversals of state policy on issues such as dam construction, at least temporarily. The NGOs nevertheless find it difficult to influence policy, having to work through official agencies whose primary interest is to “control” rather than “listen” to them. Exceptions often require special connections or status. For example, the sponsor of the first major private Chinese NGO study of the environment, *The China Environment Yearbook of 2005*, is both the founder of Friends of Nature and also a member of a famous family.

Environmental NGOs are likely to become more visible and vocal as climate change issues become more prominent. The global and domestic environmental movements are mutually influential and involvement of China’s younger generations at home and abroad will be increasingly significant. Official tolerance will be contingent on environmental advocacy remaining strictly limited in scope and avoiding broad criticisms of the party-state. In addition, given the Chinese Government’s aversion to pluralistic solutions, it may seek to develop new models of environmental protection that do not rely on environmental NGOs, even if this reduces effectiveness in dealing with climate change.

International NGOs. The Chinese Government views foreign NGOs with suspicion even though it recognizes their useful contributions to addressing many socio-economic and environmental issues. Paranoia that the United States and other foreign governments are using NGO infiltration to promote regime change in China was heightened by the role played by political advocacy NGOs in the eastern European ‘Color Revolutions’ of 2004-05. The ‘Color Revolutions’ led the government to impose a freeze on development of the non-profit sector that has eased recently as security concerns have abated. International NGOs (INGOs) nevertheless exert a significant influence on the mindset and practices of both officials and domestic NGOs in China, particularly at the local level. INGOs operating in China are expanding their employment and training activities. For example, Clear World Energy Inc., established in 2003 and headed by a Swedish national, invests in clean energy and climate change-related businesses and nonprofit social enterprises in China and elsewhere.

As China faces growing large-scale challenges from climate change, INGOs are a channel through which international funding, resources, and expertise can flow into the country to boost both state and social capacity. As their importance as environmental and social actors increases,

the party-state will most likely seek to develop institutional mechanisms to exert control and oversight over INGO activity in China. It is unclear how effective this will be, particularly as a need for climate change-related expertise and resources increases. In addition, INGO partnerships with domestic Chinese NGOs are likely to boost their effectiveness and profile, as well as making the INGOs advocates for domestic NGOs vis-à-vis the party-state.

Another important international factor is the increasing flow of international philanthropic funding into China. In order to avoid funds being diverted to corrupt local officials or to state priorities, international donors such as transnational corporations operating in China prefer to fund NGOs rather than state entities. Corporate and EU donors have been especially interested in funding NGOs who conduct green projects. This new source of funds has enhanced the resources and autonomy of many of China's NGOs, even some GONGOs. Groups raising funds overseas must choose between appeasing the local government which allows them to operate and responding to the international donors. NGOs are increasingly moving toward pleasing their funding sources to keep their cash flow steady. This practice also has increased demands for accountability and adherence to international NGO standards. This has led to the phenomenon of "NGO Incubators," organizations that facilitate the development of legitimate NGOs and connect them with international donors.

State Response

Party-State Leadership

The 200 senior officials with executive responsibility at the central and provincial levels will be responsible for the bulk of the critical decisionmaking on climate change. The senior leadership includes leaders assigned oversight of core functions such as media and education, state personnel, intelligence and security, military, and economic and foreign affairs. The senior leadership is not a static group. In the post-Mao era, China's leadership has developed a system of pre-planned generational turnover of its leaders. The most recent such turnover was in 2002, when the "Fourth Generation" of CCP leaders under Hu Jintao succeeded to power. Each successive administration brings with it a revised policy agenda, although there has so far been a great deal of overall continuity. As climate change impacts become more severe, climate change mitigation can be expected to remain important on the leadership agenda. The administrative burden on senior leadership is considerable. There is also tension between focusing on pressing problems and planning for the long term. If major competing priorities such as a sustained economic downturn arise, attention to climate change mitigation may become more rhetorical than practical.

The leadership policymaking process is not transparent, but internal leadership politics are likely to be less harmonious than they are represented. There are bureaucratic tugs of war over issues such as central versus provincial interests and environmental protection versus poverty alleviation. Leadership cliques and patronage networks advocate for their particular interests and policy preferences. The leaders of the major bureaucratic interests push their own agendas, often at each other's expense. The perennial division between leadership reformers and hardliners is likely to play into climate change mitigation policymaking. Climate change remains a fairly new issue on the national agenda, one that the leadership is not accustomed to dealing with. Climate change mitigation may require the inclusion of a broader selection of actors than the leadership is used to including in its decisionmaking, including nonstate groups. In addition, addressing climate change will require major policy initiatives and reforms, which in turn will require the hardliners within the leadership to be appeased. In the past, hardliners have

threatened to block major reforms unless they are accompanied by crackdowns in other areas. Hardline measures may be the cost of doing business for leaders pushing tradeoffs or concessions associated with climate change mitigation. This raises the concern that major domestic climate change reforms might bring with them harsh measures directed against either domestic groups or internationally.

Although the transfer of power between different leadership generations and administrations has managed smoothly for the most part, inter-generational conflicts remain an issue. The mindset of older technocrats is affected by the legacy of the hierarchical system of vertical control. Younger, better educated, better trained officials are now coming into the upper echelons of leadership, including from the quasi-private sector. They are more willing to test the limits of the system and more receptive to innovation, whether it originates inside or outside the state. This raises the question of how the Chinese leadership's approach to problems of risk and uncertainty—risk culture, risk perception, risk management—is evolving. Climate change questions involve areas of uncertainty, the assessment of which involves risks—their estimation and acceptability and the distribution of the costs and benefits of accepting risks. Chinese leaders and citizens have traditionally been risk averse, particularly the current Hu Jintao administration. Effective climate change mitigation measures may nevertheless require successor administrations over the next several decades to take substantial risks impacting critical areas such as agricultural production, water management, and industrial development. Risk-averse leaders may find themselves paralyzed, which could delay or derail an effective state response.

The People's Liberation Army. In addition to the civilian leadership, the People's Liberation Army (PLA) has a major role in setting the policy agenda, although it is increasingly less influential as the focus of the leadership has shifted to the economy. Nevertheless, the PLA receives a major share of the state's resources and can be expected to resist diverting attention to climate change mitigation. On the other hand, the PLA has a major role in responding to natural disasters such as floods, storms, or earthquakes. The PLA has cultivated a popular role as the savior of the Chinese people and will be eager to take the lead in responding to climatic disasters. The PLA also is becoming more interested in developing capabilities to respond to overseas humanitarian contingencies, which may be increasingly climate-related. Climate change has the potential to become a major new mission area for the PLA, which could become a constituency advocating for more resources for climate change response. This brings a risk because it would distort resource allocation to aspects of climate change mitigation with greater PLA involvement, which could produce a less than optimal response overall.

Regime Security. The most fundamental priority of the small policy elite who run the Chinese party-state apparatus is the maintenance of the integrity of the regime and its continued monopoly on power. They accomplish this through a combination of many means including effective repression and co-optation or prevention of the development of potential competing political groups. They have so far been able to maintain a degree of popular legitimacy even without accountability or democracy, mainly by maintaining high rates of growth supplemented by appeals to popular nationalism. Their most important credential may be their demonstrated competence in dealing with challenges and delivering results to the people. Climate change-induced challenges may put significant strain on their ability to continue to deliver satisfactory solutions. This could prompt greater resort to repressive measures to maintain CCP rule.

Regime security concerns will also likely hinder moves toward legitimating societal mobilization to help address climate change.

Development and Economic Growth. Continued economic development and sustained high rates of growth are a key priority for the party-state. Since the economic reform era began in 1978, the ability to facilitate continued economic growth has become the principal credential legitimizing the regime's unaccountable monopoly on power. Development is seen as a basic right that cannot be infringed upon. At the same time, previous development patterns in the region, such as in Japan or South Korea, demonstrate that the rate of growth eventually reaches a plateau as the economy nears developed parameters. The rate of economic growth in China is already decelerating, raising regime concerns about arresting any further decline. Reductions in growth could have profound political implications because much of the regime's popular legitimacy depends on continued high growth rates. On the one hand, climate change-induced challenges will likely place growth in jeopardy, increasing the regime's incentive to deal with such challenges effectively. On the other hand, certain types of mitigation measures, such as curbs on industrial energy use, as well as reallocation of resources to address climatic impacts, also could threaten China's ability to grow.

Despite the emphasis on growth, China's leaders realize that unrestrained growth cannot continue without attention to other development objectives such as education, the environment, promoting innovation, reducing inequality, and promoting a harmonious society. China's current five-year plan for 2006-2010 set forth new goals to address climate change as part of a shift in development strategy from rapid growth to sustainable growth. This shift had been foreshadowed by the adoption of a concept of "Scientific Development." Scientific Development is China's conceptualization of many of the elements associated with international models of sustainable growth. While it is admirable in theory, few in the government fully understand what the term means and inculcating it into the state bureaucracy has proven difficult. Moreover, the current economic slowdown has made achieving the restructuring goals of the current five-year plan unlikely. The draft under way for the next five-year plan, which probably had impressive climate change goals, probably is undergoing significant reworking.

Internal Stability. The concern of China's leaders with internal stability is a subsidiary expression of their overriding priority of regime security. Of all the top-tier state priorities, internal stability is likely to suffer the most direct challenge as a result of climate change. Given the projected scope and secondary effects of climate change, China will face significant political instability. Although this may create incentives for greater resource allocation to climate change mitigation, there are also many other projects where funds can be used to shore up state stability. The regime risks treating the symptoms—socio-economic and resource conflicts, displacement of populations, and humanitarian crises—rather than addressing the climatic root causes. In addition, especially at the local level, long term actions for climate change mitigation may be sacrificed in order to maintain near term social order, for instance if employment is threatened.

State Capacity

In many ways, the capacity of the Chinese state is increasing and the government will likely be able to address the consequences of climate change with some success. The state is experienced in coping with large-scale challenges and has amassed a good track record of doing so effectively. The economic and socio-political challenges from predicted climate change seem less difficult than the challenges from China's economic reforms in recent decades. Those reforms have fostered a comprehensive state system for financing and implementing a fast-paced

and successful development program. This system also provides the state with ideal mechanisms for funding and supervising a wide range of programs that both respond to immediate climate-change-induced crises and longer-term impacts of climate change.

Over the past 30 years China has refilled reservoirs of social capital, built up technical and human resources, and developed institutional adaptability and national scientific and technological capabilities that should allow it to manage the challenges of climate change. The state has become more professionalized, its revenue base is ample, and it has demonstrated effectiveness in mobilizing funds for use in public investments and crisis-related outlays. It has been willing and able to borrow from the best global practices in developing policies. Its mechanisms of social control, increasingly tested, remain quite functional.

China is pouring a lot of money into social safety nets such as the healthcare and welfare systems. These systems have been acutely under-developed and remain inadequate but are improving quite rapidly. Nevertheless, the scale of the problems social safety nets will be called upon to deal with may increase exponentially due to climate change impacts.

China's wealth and state capacity can be expected to grow significantly over the next 20 years. By 2030 China will most likely match the United States in the overall size of its economy, albeit at a significantly lower level of per capita GDP. Although the challenges it will face are daunting, overall state capacity should be sufficient to manage most contingencies out to 2030. Beyond 2030 the ability for the state to respond is more problematic.

State Planning and Policymaking. China began long-term, twenty year projections focused on population and resources as early as 1980. State research on sustainable development picked up steam starting in the early 1990s. These projections are incorporated into the cycle of Five Year Plans that form the long-standing structure of China's development policy planning. In recent years the state's long experience with 5, 10, and 20-year projections has been bolstered by the availability of more and better quality data and more openness to inputs from outside experts. The capacity of the central government to research and plan for environmental protection, energy conservation, and climate change has steadily improved.

China's reliance on expertise from the state bureaucracy and think tanks in formulating policy has proven surprisingly effective. Nevertheless, this policymaking process is changing. Although still mainly a closed process, policymaking is increasingly open to input from a broader spectrum of elites in business, academia, and the sciences. The composition of the senior policy elite has shifted, primarily through the inclusion of representatives of the leading sectors of the economy. Executives from the energy, petroleum, steel, and banking sectors have increasingly superseded ministerial bureaucrats on the Central Committee. Although in the state corporatist system the role these business leaders play is not distinct from the responsibilities of government ministries for their sector, this shift will likely result in policies more favorable to private industry, possibly at the expense of overall national interests. Government by experts may increasingly be replaced by government by commercial interest groups. The bureaucrats and experts of the National Reform and Development Commission and State Council's Development Research Center will have a hard time forcing climate change policy decisions over the heads of powerful corporations.

Policy Implementation. Despite effective state planning and policy decisionmaking, translating goals and guidelines into actual policy changes and implementing them down to the local level remains a substantial challenge. The growth of the market sector and decentralized political

authority combine to create a mismatch between central goals and results on the ground. China's policy record since market reforms began in 1978 illustrates that the state's policy implementation capacity is considerable when it is fully applied, but only top priority issues receive state attention. Many Chinese policy statements, laws, and regulations focused on environmental protection receive high marks for language, concepts, and intent but are not effectively implemented or enforced. In part, they may fall victim to competing priorities. China's robust stimulus and infrastructure investment program in response to the global financial crisis, for example, may hinder or overshadow the implementation of policies designed to mitigate climate change through a less energy intensive path to development.

China's impressive state capacity will mean little if climate change does not remain a top-tier state priority and receive the full backing of the central government to ensure local compliance on policy implementation. Although China's leaders have been calling for local leaders to pay attention to these problems, they have not always pushed environmental policies hard enough. In some cases, the central government has responded to difficulty in implementing new laws and policies by giving up and deferring them for considerable periods. Weak attempts by the state center to implement best environmental practices are readily circumvented by local power-holders prioritizing their own income possibilities and growth at any price. From the local perspective, the capacity of the state to carry out environmental policies looks less than impressive. An additional roadblock to policy implementation on environmental and climate change issues is the inadequacy of the State Environmental Protection Agency. It is understaffed, under-resourced, does not have significant reach into local levels of government, and lacks the authority to close down polluters.

Policy implementation is also hampered by a longstanding political phenomenon regarding rhetorical initiatives originated from the senior leadership, dating back to the Mao era. China's political leaders have a tendency to make pronouncements using symbolic rhetoric, such as "Cultural Revolution," "Three Represents," or "Scientific Development," the meaning of which is unclear to the vast majority of state and party officials. The bureaucracy then shifts to implement the new policy without a clear understanding of what it means. A process of trial and error then ensues until the leader provides positive feedback on the results. In the meantime, policies may not be implemented or may be incorrectly implemented in an inconsistent fashion across the system. Anecdotal evidence suggests that climate change and environmental initiatives may be susceptible to this problem.

Crisis Management. China's ability to draw on major national resources to address both natural and political crises to 2030 rapidly and effectively will be substantial. China has experienced an impressive crisis management learning curve based on the lessons of the 1998 "once in a century" floods, the 2003 SARS epidemic, the snowstorms in south China, and the 2008 earthquake, as well as military tension or incidents involving the United States. Emergency management response capabilities have improved and building state capacity for crisis management remains a high priority. China's currently evolving crisis management systems should be able to handle projected climate change-related challenges satisfactorily. The government's crisis management capacity may be less of a problem than its capacity to maintain discipline in enforcing remedial measures once a crisis has passed.

Limitations on State Capacity. The Chinese state continues to exhibit chronic problems that limit its capacity. These include well-known problems of governance such as weak inter-ministerial coordination to overcome stove-piping, local governments resisting national policy

directives, and endemic corruption. Predictions about state capacity to respond to climate change need to take the limitations and internal contradictions within the system into account.

China's state structure is still organized according to a residual Leninist "stovepipe" command and control bureaucracy. The state is divided into vertically-organized functional hierarchies each responsible for a particular sector or functional area of state activity. These hierarchies extend all the way from the upper echelons of the central government down through the provinces to localities and into segments of civil society associated with the hierarchy's area of responsibility. This structure facilitates central control of critical issue areas, but the stovepipes tend not to interact with each other. There may be insufficient coordination between parallel offices responsible for coal or rail transportation in a particular province, resulting in duplicating efforts and wasting resources. In addition, the CCP has its own parallel, duplicate structures at all levels of government.

Overall, the stovepipe state corporatist structure, while it provides the state with formidable abilities to marshal resources and personnel, is wasteful of state capacity. As climate change constrains state resources, this may become a serious deficiency. In addition, climate change produces broad-based effects that will require effective coordination and tradeoffs between many functions of the party-state, cutting across the bureaucratic stovepipes. This may be resisted by bureaucratic elements with a vested interest, perhaps involving patronage relations, in the existing hierarchical administrative system.

Center-Local Conflicts. Government authorities at different levels of the government—central, provincial, and local—have significantly divergent institutional interests. Following the reconsolidation of tax revenues in favor of the central government in 1994, many provincial and local governments were left with large ongoing budgetary shortfalls. Local levels of government in the agricultural heartland of central China, which will be hard hit by climate change-induced challenges, are particularly impoverished. The central government continues to delegate increasing administrative responsibilities to the provincial and local level, often in the form of unfunded mandates. The resulting major gap in interests and financial resources between the different levels of government is a primary challenge for effective state response to issues such as climate change.

Chinese leaders probably will see climate change as prolonging the need for efficient centrally directed capabilities. If China's leaders are as committed to improving the environment as they seem, they are in a position to address at least the worst problems resulting from climate change. The recentralization of finances has provided the center with the funds to address pressing large-scale issues, such as environmental issues or the current economic crisis. This centralization of finances also strengthens China's hierarchical political system, which has both advantages and disadvantages. As long as higher levels have funds, lower levels will look to them rather than the constituents they are supposed to serve. This system undermines responsiveness to lower levels while increasing the control of higher levels. Not only is any transition toward democracy undermined, but it appears that the incentive to provide public goods, of which the environment is a prime example, is diminished. On the other hand, higher levels can demand compliance with targets for public goods such as the environment.

Although climate change will require centrally administered solutions, effective responses also will depend heavily on crisis management, effective policy implementation, and innovation at the local level. A paradigm shift among the rank-and-file Party and state bureaucrats and local

officials will also be necessary if climate change mitigation is to be successfully implemented. Despite incorporating “Scientific Development” goals into the official cadre evaluation system, the Party’s personnel system has yet to overcome the de facto incentives for local officials to pursue immediate gains from “rapid growth at all costs.” Although local officials will be happy to submit huge “wish lists” for central funds to deal with climate change, the local focus for actual projects will be on very short-term priorities, not long term climate change. Local leaders will be in a very difficult situation as internal instability driven by climate change increases. They typically seek to avoid and suppress problems rather than address them.

The central government may set climate change-related policy targets, but such targets can be difficult to measure and easy to evade. The failure of the central party-state to effectively empower local levels of government or enforce its dictates will undermine its legitimacy. This will have important political ramifications, both positive and negative. Given various types and differing severity of climate change effects across different parts of China, many problems would be more effectively dealt with at the provincial level. There may be increased incentives to move toward a truly federal system with greater authority accorded to the provinces. Local authorities may also become more reliant on international and local NGOs and private philanthropy to bolster their capabilities. Instances such as the Sichuan earthquake demonstrated that NGOs and civil society can effectively contribute. Increased dependence will likely render local authorities more responsive to civil interests, regardless of whether there is a formal opening or democratization of the government. On the other hand, local discontent can be expected to increase, particularly if responses to climate change-induced crises are ineffective. A vacuum in local state capacity may allow local criminals and gangs to usurp control in some areas and corruption and black market activity probably will be exacerbated.

Corruption. Corruption and black marketeering remain prevalent in China despite periodic vigorous official anti-corruption campaigns. Corruption results in substantial diversion of state and private funds and resources away from their intended applications, reducing state capacity. Corruption concerns impose extra oversight burdens on the central government and popular perceptions of corruption undermine regime legitimacy. Although most corruption operates at the local level, local governments typically lack the authority to deal with corrupt officials, forcing the central government to take responsibility.

In addition, economic development also has allowed vested interests to become more entrenched and state and private enterprises to become increasingly blurred. Elite families and state and private sector leaders have formed complex patronage networks that seek to maintain the status quo and enrich their members. To date, corruption in China serves as a market mechanism compensating for bureaucratic inertia. The rise of corrupt elite networks may make more obstructionist forms of corruption more prevalent. The requisite flow of resources to local levels of government and proxy actors to address climate change-induced challenges may increase the opportunity for corrupt actors to enrich themselves at the expense of successful responses to the problems.

Prospects for State Failure

China’s party-state will face significant challenges as a result of climate change. In addition to overall social, political, and economic challenges, it will have to overcome or mitigate systemic contradictions within the party-state itself. Nevertheless, it seems highly unlikely that climate change will cause a complete failure of the Chinese state, or even a sudden violent change of political system within the next two decades. Although it may face political crises, for example

due to a succession dispute or failed political reforms, China's commitment to maintaining its economic momentum and innovativeness will not be derailed by climate change. China's trajectory of increasing state and civil capacity mitigates the prospects that even large-scale challenges will lead to a critical failure.

On the other hand, both the central government and civil groups in the quasi-state and private sector have increased their capacities partially at the expense of local and provincial government capacities. Local and provincial institutions will bear the brunt of climate change-induced challenges. Unless they are properly resourced or the central government or civil groups step in to support them, acute climatic impacts could produce partial state failures at the local or even provincial level. Such localized failures are likely to prompt greater central government intervention and more resource allocation to response and mitigation measures.

State Climate Change Mitigation Policies

In the 2008 update to the current five-year plan, China adopted an ambitious and unprecedented set of sustainable development and climate change goals under the banner of the National Climate Change Program (NCCP). The NCCP reflects strong national leadership and a nationally-coordinated, professionalized response to both international trends and obligations as well as to domestic challenges. China is nominally making a major push to increase its overall adaptive capacity to cope with climate change, including raising public awareness, enhancing research and development, and seeking to leverage international resources. There are nevertheless grounds for caution in taking China's claims about future commitments or demonstration projects at face value. Past initiatives often have proven to be a combination of wishful thinking and public relations.

China can readily adapt the administrative system it used to finance and implement a fast-paced and successful development program to develop and implement climate change policies. The kinds of investments and economic policy adjustments that China has been implementing for at least 30 years can also be used to manage climate change. Measures such as price increases, investment outlays, and precautionary preparations have long-run importance for reducing the severity of subsequent outbreaks of climate-change-related events. Institutions and mechanisms such as China's planning commissions and government-guided investment programs are also the ideal for funding and supervising a wide range of programs that both respond to immediate climate change-induced crises and longer-term responses to climate change.

Developing effective responses will nevertheless be a daunting task. Many of the required initiatives are very large scale and costly. Chinese policymakers in any case tend to think big in terms of solutions, such as moving the capital south or diverting whole river systems north. The lack of capacity at the local and provincial level, as well as the inter-provincial and cross-border nature of many of the major climate change-related problems, will strengthen the central government's role in addressing them. The lack of transparency in China's policymaking may have a problematic effect on policy selection. Leaders may be inclined to keep the most severe problems secret. Without feedback from the public and a broader selection of officials in the affected areas and nonstate experts, the internal state debate may produce consideration of drastic measures that could put large populations at risk. Issues of corruption and poor preparation will crop up, but the current trend in China shows the high likelihood that appropriate reforms and policies will continue to emerge.

China will most likely turn to a variety of different approaches to manage climate change-induced challenges. The degree of climate change, the severity of the impacts, and their timing will have a decisive impact on where China ultimately decides to place its emphasis. Taken as a whole, China's responses to climate change are likely to result in an increasingly human managed environment. That is, state action on a large scale will alter the country's environment to mitigate or compensate for climate change. It seems inescapable that this project of environmental management will increase China's claims on global energy and other resources, but depending upon the technological trajectories of the project, relatively more or relatively less energy and resources could be required.

Incentives and Market-based Structures. Climate change mitigation will require comprehensive attention to adjusting incentive structures in China's economy, society, and government. China is likely to accelerate introduction of market-based incentives for sensible urbanization, migration, and business location decisions better adapted to climate change. For example, the state could have a major impact on the nature of urban expansion through building codes and taxes on materials.

The party-state will also need to create incentives for its own officials to focus more on climate change. The major professional incentive structure for lower level government officials is the cadre evaluation system which measures their performance. The cadre evaluation system emphasizes measurable achievements in areas like revenue collection, public order, and family planning, with the greatest weight being placed on economic growth. By making economic development the number one criterion for cadre evaluation, the party-state aligned personal and local interests with national goals. The resulting emphasis on economic growth is at least in part responsible for China's ability to rapidly implement economic development policies. This strategy has also had more problematic effects in terms of causing officials to engage in cutthroat competition to gain recognition of their jurisdictions as leading producers, with no regard to environmental consequences or efficiency.

The cadre evaluation system could in theory be used to promote progress on climate change mitigation. The adoption of "Scientific Development" in fact prompted efforts to incorporate environmental protection into the evaluation system. In practice this has not been very effective because environmental improvements are difficult to measure compared to other elements such as economic growth. The government attempted to develop a "green GDP" to act as a metric but has for the time being abandoned the idea. If an effective climate change mitigation metric could be developed and incorporated into the evaluation system, it would create a significant incentive for lower-level officials to implement state climate change and environmental policies, albeit possibly in an inept or superficial fashion.

Resource Price Reform. China has benefited from low prices for energy, water, and raw materials, which is one of the driving factors behind China's wasteful and profligate economic development pattern. Resource prices are already on the rise as a function of growing demand, but China is also becoming a wealthier country more able to continue to afford higher prices. To raise costs sufficiently to create incentives for conservation and greater efficiency, the state may need to intervene by imposing taxes on resource use and regulating rates. Price reform on its own may not be sufficient without other changes in usage patterns and incentives because resource demand is in many cases fairly inelastic.

Conservation and Rationing. Rationing of critical resources is an unattractive option for a number of reasons. Less available resources will be a constraint on continued economic growth, with attendant risks of unrest and loss of capacity needed to deal with climate change. Severe rationing may generate prompt political unrest among affected constituencies. In addition, rationing systems are an open invitation to corruption in allocation decisionmaking. In spite of these major disadvantages, the Chinese Government may have little recourse but to impose rationing if price reforms and infrastructural solutions do not keep pace with water, energy, and other resource shortages brought on by climate change.

Voluntary conservation is a different matter. China's leadership is aware of how wasteful and inefficient many of the country's economic structures and practices are. The leaders are equally aware that resource constraints will shortly become a hard reality in China. Some degree of conservation, rationalization, and increased efficiencies will be a necessity. Accomplishing this proactively and on a gradual basis is clearly preferable to being forced to do so under crisis pressures. Two principal factors have constrained movement on conservation. Waste and inefficiency are so ingrained in China's current industrial system that enforcing conservation could constrain growth, something China is not willing to do. In addition, industries and local officials have little systemic incentive to want conservation and have often proven able to avoid or deflect central government initiatives in this area. Progress will require stronger state commitment, altered incentive structures, and greater pressure on offenders. The state may be able to leverage the support of NGOs or the public at large in bringing pressure to bear.

Enforcing Environmental Standards. China will face major proximate challenges from pollution of air and water, particularly in urban areas. What China does to address its pollution problems could be key in determining the direction of its carbon emissions. For example, if China switches to cleaner power to reduce aerosols, greenhouse gas emissions could also be reduced while if they just put screens on their smokestacks to capture aerosols, greenhouse gas emissions will continue. Although China in many cases has industrial and environmental standards on the books that exceed those in fully developed countries, the Chinese treat them as eventual goals rather than putting them into practice. The problem of lagging policy implementation needs to be attacked head on. In the automobile industry, for example, China's standards are higher than the US Government's Corporate Average Fuel Economy (CAFÉ) standards. Although the principal purpose of the high standards is to disadvantage foreign manufacturers, if implemented effectively they would substantially improve fuel economy. Instead, they are largely ignored and China's cars remain inefficient. Because the state attempts to keep fuel prices depressed to bolster economic growth, there is little market incentive to move to hybrids or other high-efficiency vehicles. This may change since China is positioning to becoming the main electric car producer.

Infrastructure Solutions. China has a long tradition of developing and maintaining large-scale infrastructure to manage weather and climate contingencies. For example, the government has made substantial flood control investments and maintains dikes and river embankments. Climate change-induced challenges will necessitate infrastructure projects on the largest scales, involving massive expenditures of resources and manpower. Climate change-augmented urbanization will necessitate major expansions of transportation, power, and communications infrastructure. Major infrastructure projects will be necessary from the local to the national level, in sectors ranging from agriculture to water management and energy.

Crisis Management and Disaster Response. China's current government has already demonstrated a strong ability to be able to respond, with military personnel as the core resource, to provide relief services when serious natural disasters strike. Each severe climate change-induced event such as a drought or storm will bring a flurry of costly emergency assistance, such as water trucks, food, income supplements and government-directed bank loans to offset short-term hardships. More frequent extreme weather events, particularly if they occur in quick succession, will put a premium on building state capacity for crisis management, including development of emergency manpower other than the army. Increasing recourse to allowing responses from groups in civil society such as NGOs may be necessary.

Managing Public Responses. China has a long tradition of expecting good government to plan for and respond effectively to natural crises. As China grows wealthier and more resources are available to the state, public expectations undoubtedly will only grow higher. Failure to effectively deal with climate change-induced crises will erode regime legitimacy and threaten political stability. In many cases, political repercussions from climate change will be difficult to distinguish from the political repercussions of major economic reforms. Chinese Governments at all levels will need to discern which public complaints are legitimate and which are not. Chinese authorities are almost certain to continue to develop the combined strategy of ameliorating underlying conditions responsible for social unrest while using the People's Armed Police to assure social stability and minimize property damage and loss of life.

Overall Economic Restructuring. China's economic development already dictates a move away from heavy industry and toward services and production of domestic consumer goods. Nine percent growth in per capita consumption is more beneficial to the average Chinese citizen than 13 percent overall GDP growth based on exports and investments. This shift may also constitute an effective climate change mitigation strategy, a synergy that may provide considerable impetus to effective climate change responses in China. Heavy industry such as steel production is very resource-intensive, not only in terms of raw materials but also water and electricity. Economic restructuring will inherently facilitate greater resource efficiency and slow the growth in demand for energy. The Chinese Government also recognizes that improved efficiency and profitability requires that they start moving industrial production offshore, to Brazil, for example, then selling it back to the growing Chinese consumer market. Despite the emphasis of recent economic growth, China does not enjoy a comparative advantage in heavy industry. For instance, steel produced almost anywhere else will require a less carbon-intensive process than in China. As China's industry moves offshore, additional opportunities to improve efficiency will open up.

Energy Policy

China's ongoing economic development will drive continued increases in energy demand for some time to come. The Chinese leadership will not accede to limiting energy use if it is at the expense of economic growth. Nevertheless, they are committed to improving energy efficiency. The Chinese are already becoming more efficient in certain areas. For example, modernization of plant and equipment is replacing older, inefficient equipment with more efficient, newer equipment. There is plenty of opportunity to extend such improvements, for example by adopting a low resistance delivery system for electricity to reduce waste in transit.

In many cases, China already has access to the technological solutions it would need to reduce emissions and increase efficiency of resource use, but simply doesn't implement them because they would raise production costs. For example, the simple step of washing the coal used in China's power plants before burning it would measurably reduce emissions, but carries a high

costs both in money and water. In cases such as this, the state can encourage implementation by fining polluting industries.

Energy costs in China are already increasing, which in theory ought to result in moves toward conservation and efficiency of use. In practice, China's current industries have relatively inelastic energy demand, so their energy usage has continued unabated. Energy-inefficient but cheap industrial processes have hampered efforts at using rate hikes to encourage energy conservation; even with rate hikes, payments have been delayed, with no concrete moves toward improving efficiency until the state actually shuts off the power. It would obviously be very economically disruptive for the Chinese Government to take such steps on a wide scale. China's planned move away from its export-led heavy industrial economic model may provide a solution. Services and consumer-oriented industry not only use less energy but have greater energy demand elasticity, so they will be more responsive to energy prices and ready to accept rational conservation measures. A slowdown in steel and cement production could produce a reduction in green house gasses equal to the output from Germany's entire coal-based generation.

Energy supply is as much of a concern for China's leaders as energy demand. China places a premium on security of supply in its energy policy. Any limits to China's access to energy is perceived as a threat to job creation and regime stability. This is problematic in that China's domestic energy resources are in most cases limited relative to its energy demand. In the case of electricity, energy security dictates reliance on abundant but polluting domestic coal. Coal cannot provide the whole answer, and for other types of energy such as fuel for transportation, China's policymakers know they will have to depend on foreign energy sources. They have tried to compensate by seeking to purchase direct control of energy sources rather than relying on international energy markets, but that has not worked in practice. Even China's own state-owned energy companies sell most of what they produce on the international markets rather than providing it cheaply to China.

Control of supply routes such as the Arabian Sea or Straits of Malacca by potentially hostile powers such as the United States renders China's practical energy security illusory. Climate change may actually improve China's foreign energy supply options. Warming may make arctic energy more accessible and open the sea lanes through the Arctic Ocean, potentially as early as 2015. China has ad hoc status as a non-arctic state in the Arctic Council and is beginning to build ships to meet arctic standards.⁶ The arctic route may provide China cheap access to Russia's oil and natural gas, particularly as more Siberian ports become accessible.

Energy Production. China's energy production profile is likely to change significantly over the next two decades. Ideally, China would like to move away from coal, both because it is carbon-intensive and polluting and because the coal mining industry is unsafe and the government would like to shut down many mines. It currently has no other cheap, secure short-term options, but this is beginning to change as structural changes in the coal industry raise production and transportation costs. In any event, China's coal supply will begin to approach inadequacy by 2030, mandating a shift to other energy sources. The capital investment in China's coal-fired power plants will likely not inhibit such a shift. China's controlled financial system means that the building costs are depreciated after a decade, so abandoning the plants does not generate a

⁶ The Arctic Council is an intergovernmental forum promoting cooperation, coordination, and interaction among the arctic states, with the involvement of the arctic indigenous communities and other arctic inhabitants on common arctic issues, in particular issues of sustainable development and environmental protection in the Arctic.

loss. Coal will remain a prominent aspect of China's energy production profile, but its relative and absolute share of production will decline considerably over time.

Petroleum constitutes China's second most important energy source. Although China has domestic oil fields, they do not approach levels where self-sufficiency is an option. There is a strong push to reduce the demand for oil, but projected increases in demand from private automobiles and other modes of transportation render such efforts unlikely to succeed. Even if China aggressively pursues a de-carbonization program, projections indicate that emissions reductions for the first 25 years will come from industry and power generation. Oil demand for transportation will most likely not decline significantly until after 2030.

Nuclear, hydroelectric, and renewable sources such as wind and solar will most likely assume increasing importance in the Chinese energy sector. China's electricity production capacity is projected to grow to 1,000 gigawatts by 2020. Fossil fuels could provide about 700 gigawatts, but at the cost of massive carbon emissions that would have a profound impact on the world climate. If China were to cut its fossil fuel use by half, it would need to make up about 650 gigawatts from other sources. China is looking to develop smaller, safer nuclear reactors and could fairly quickly build up its nuclear energy program to produce up to 250 gigawatts of electricity. Non-hydroelectric renewable may be able to eventually provide a further 200 to 250 gigawatts.

China has a number of large-scale hydroelectric projects in the planning stage, including the Tsangpo project in Tibet, which would be the world's largest. Climate change may impose significant limits on the reliability of hydropower, since a combination of glacial melting and reduced or more irregular rainfall is likely to cause reductions in river flows. There are also significant regional implications associated with all-out hydroelectric exploitation of the Himalayan watershed because many of the rivers in question terminate in other countries. The actual potential of hydropower may be markedly less than the theoretical hydroelectric contribution of up to 300 gigawatts. Nevertheless, taken as a whole, other energy sources could feasibly compensate for a 50 percent cut in fossil fuel consumption in China.

Natural Gas. Despite impressive gas finds inside China, there is not enough domestic natural gas to accommodate a major expansion of natural gas use as a cleaner alternative to coal and fuel oil. Despite concerns about security of supply, Chinese companies are aggressively pursuing natural gas contracts overseas. The most likely supplier would seem to be Russia, but in practice there are major drawbacks. Despite more than a decade of negotiations, little headway has been made on building natural gas pipelines from eastern Siberia to China. Even if agreement on pipelines could be reached, the economics of Russia's gas markets are unfavorable to China. Chinese consumers will never pay for gas what German utilities pay for it, so Russia will send the gas west rather than east. In addition, Russian gas would have to be piped right past existing natural gas fields in western China to reach consumers on the coast. China therefore might as well exploit its own fields. Moreover, Russia has shown itself to be a very unreliable supplier, repeatedly shutting off gas to Ukraine and Europe for political reasons.

The pipeline plans were also made when prices for liquefied natural gas (LNG) were higher. LNG is now a much more attractive option for China than gas pipelines. It can be delivered by tanker to China's eastern urban centers. China has focused on Iran, Qatar, Indonesia, and Australia as potential natural gas suppliers. Iran may not be a viable option so long as international sanctions remain in place. It lacks liquefaction technology to convert its gas to

LNG form and sanctions bar China from providing it. As an alternative to costly pipelines, Russian natural gas could be liquefied and shipped to China by sea. The opening of arctic shipping lanes and Siberian ports may make this option a viable one.

If China can secure an overseas supply, LNG power plants are significantly cleaner than coal- or oil-fired plants. An LNG plant produces about half the carbon emissions of the most efficient coal-fired power plant, let alone the average Chinese coal-fired power plant. China's plans call for the construction of 15 LNG power plants, but such plans are always more ambitious than reality. The scale of energy production involved means that even 15 plants would not decisively reduce China's emissions. In the long term, world natural gas markets will continue to be tight, limiting its potential as an expanding source of energy for China. In practical terms, while China's LNG expansion will have a major impact on the world LNG market, it will likely not have such a large impact on China's emissions.

Water Policy

China's climate change mitigation policies will in the first instance depend on how the government handles the major hydrologic changes that will occur in the country. Water scarcity, particularly in the north, will force either wholesale population movements out of the most severely affected areas or massive diversion of water between regions. Either of these results would impose a daunting logistic burden on the Chinese state. The state's initial approach has been to deal with the problem through large-scale infrastructure projects in the same vein as the Three Gorges Dam. China already has initiated a massive South-to-North water diversion project, which will use thousands of miles of canals to divert water from the Yangtze River to the Yellow River. The first phase of the project is scheduled to be completed next year, the second phase by 2030. Additional large-scale infrastructure projects of this type will be required to address the escalating northern water crisis. Such projects are nevertheless only likely to alleviate, not solve, the problem of water shortages.

China's current government has already demonstrated a strong ability to be able to respond, with military personnel as the core resource, to provide emergency assistance when water-related crises such as floods or drought strike. Depopulation of rural areas through migration to cities will somewhat ease pressure to occupy rural areas most at risk for water-related crises. On the other hand, urbanization, particularly the expansion of cities in the drier inland areas, will necessitate major investments in urban water infrastructure, from the level of increased water piping in individual buildings to new reservoirs and water treatment plants. There is a risk that if this is undertaken at the local level, it will be done in a wasteful and irrational manner that worsens water inequalities between cities and between urban and rural areas. A large degree of central planning may be needed on allocation of water resources, to include water rationing and economic incentives for sensible construction and investment patterns.

The state can employ market-based mechanisms to create incentives for water conservation or changes in water-use and settlement patterns. Ideally, as Chinese society becomes wealthier, water will get more expensive. In practice, the true public cost of water may not be passed on to the consumer. The state can compensate for this by raising water charges and levying higher taxes on drier areas. Large infrastructure costs will be associated with providing water in some areas but not in others. The pricing of water by location has been politically unpopular but would help reconcile water demand with water availability. Taxation levels and water fees that reflect the true public cost of sustaining economic and household activities in drier northern China will facilitate longer-term beneficial market-based adjustments in behavior such as

conservation and migration to wetter regions. In addition, China's heavy industry is very water-intensive, so higher prices will also incentivize the desired transition to a service and consumer goods-based economy.

Enforcement of a water pricing mechanism could be difficult, as cutting off water to businesses and households in payment arrears will generate backlashes. Corruption and favoritism in allocating rates and forgiving payment arrears are likely, and even if they do not widely occur, the public is likely to perceive them. Because of the political risks, political gridlock or weak policymaking could hinder the raising of prices, although each severe water shortage will increase political will to take action. The state could also require purchase of insurance against flood and cyclone damage in wetter areas or drought or water shortages in drier areas. This sort of insurance can convert large infrequent crisis-inflicted costs into predictable significant annual charges. Such predictably higher payments in crisis-prone regions will create an incentive framework for sensible crop selection, housing, and business location decisions.

Agricultural Policy

One of the major decisions the state will face is whether to permit and facilitate diversification away from grain production. Most agricultural studies suggest that failure to do so will significantly hamper the adaptive capacity of China's farmers and lead to significant declines in production. A transition to higher-value crops that are less water-intensive will be necessary for farmers to maximize profitability in drought-prone regions. In addition, such crops can be profitable on smaller agricultural plots, whereas grain is only profitable on large plots using mechanized farming. This switch would therefore facilitate the continuation of labor-intensive small farming, easing pressures of migration to cities.

Despite the advantages of permitting crop switching, China's leaders may be reluctant to accept such a solution. Cheap grain is needed to feed urban dwellers and the military, so a move away from grain production is a strategic decision that would have to be made at the highest level of government. The government may prefer to increase subsidies for grain production to avoid becoming reliant on foreign sources. Perhaps the one area in which China has maintained near total self-sufficiency has been agriculture—if one ignores China's large fertilizer imports. Food security, and grain self-sufficiency in particular, is an almost sacrosanct strategy. The Chinese Government has stated frankly that agricultural self-sufficiency is necessary to ensure social stability and that in an international crisis food might be used as a weapon. Subsidies nevertheless cannot mitigate the basic problem that grain-based agriculture will face decreasing productivity due to climatic shifts. In the longer term, China will be forced to go to the international market on a large scale, raising the question of whether the world is capable of "feeding China." China's food procurement policy may parallel its overseas energy policy. China may create agricultural trading companies similar to its state-owned oil corporations and seek to purchase overseas farmland suitable for grain production. As with energy, these policies will most likely not be able to free China from the global food market.

China is reforesting, converting uplands from grain to forestry that will act as a terrestrial carbon sink. In combating erosion, China's long experience with tree-planting and dune-fixing as steps to fight desertification should continue to attract government resources, especially as grazing pressures subside and allow such programs to be more effective. Enhanced government investments of the kind already implemented so widely have a high likelihood of adequately moderating increased eruptions of dust storms and continued spreading of deserts.

Regional Implications

The trans-border impacts of China's environmental problems are of concern to many countries as other countries will feel the effects. It seems unlikely that this situation would lead to international conflict, but it could lead to increased political tensions, regional economic disruptions, and deterioration in the quality of life for hundreds of millions in the region.

As resources become more constrained, while China's resource demands continue to grow, China will likely seek to assure its access to critical resources on its periphery. Such resources could include energy resources in Siberia, Central Asia, and beneath the China Seas; water resources in the Himalayas and in Siberia; and arable land that might open up as climate zones shift. China's capacity to take action to secure its vital interests can be expected to improve as it continues to develop its military capability.

Regional Water Issues

One of the more direct consequences of climate change for the region may be seen in South and Southeast Asia as a result of the combination of glacial melt in Tibet and Chinese river management practices. The Himalayas and Tibetan Plateau form the principal watershed feeding the rivers of East, South, and Southeast Asia. Through control of Tibet China can exert source control over much of the water in those regions. China's development program in Tibet has not traditionally taken into account the fragility of the plateau or the interests of downstream countries. As climate change imposes increasing water scarcity on China and other countries in the region, the water resources of the Himalayas will become an increasingly important strategic asset.

The implications of China's water management decisions are already becoming a major long-term national security concern for countries such as India and Vietnam. China is engaged in a number of major hydroelectric projects in Tibet that threaten the water access of South and Southeast Asian countries. Projected hydrologic effects of climate change on China dictate that China's interest in Himalayan water will most likely shift from hydropower to irrigation and drinking water. Chinese planners are well aware that projected water scarcity will necessitate large-scale diversion of water to address domestic needs. As scarcity becomes more severe, China will have very little room to compromise with downstream countries.

China is in a very good position with regard to Himalayan water. Not only does it securely control the sources of the major rivers, but existing international law favors the upstream country in disputes over water rights. Despite the existence of regional water management institutions such as the Mekong Commission, China has little incentive to consent to some form of equitable regional water management scheme. Cooperation would, by default, reduce China's control of critical water resources it will need in the future. Downstream countries have little recourse. None is in a position to challenge China's upstream control of the rivers, and initiating a conflict over water rights would risk potentially catastrophic Chinese reprisals such as wholesale diversion of rivers. The water issue is nevertheless likely to create serious ongoing tensions that may play themselves out in other venues. In the longer term, conflict could occur over Siberian water resources, including not only the Amur River but Lake Baikal, which holds the world's largest single volume of fresh water.

Aerosols

China has one of the largest dust contributions in the world from dust blowing off of the Gobi desert and its industrial and environmental aerosols threaten other countries in the East Asian

region. Continued drought and desertification in northern China will increase the trans-border movement of dust and other particles, to the immediate detriment of Korea and Japan, with impacts on North America and the global climate as well. Countries on the receiving end of China's aerosols have incentives to assist China in coping with its air quality challenges, through technology transfers and provision of funding for aerosol mitigation measures and reclamation of denuded land.

Regional Migration

Cross-border migrations prompted by climate change could prove destabilizing for China as well as its neighbors. Whether migration occurs into or out of China will depend on relative neighboring government successes in addressing the effects of climate change.

Chinese Emigration. Emigration into neighboring countries such as Russia, Mongolia, or Vietnam might act as a safety valve for China's population in response to acute climatic stress. The capacity of those countries to accommodate large numbers of Chinese immigrants is nevertheless limited even without climate change-imposed resource constraints.

Emigration from China is not likely to be confined to China's Han majority. Ethnic minorities such as Mongolians, Uighur, and Tibetans might cross the borders into Mongolia, Central Asia, or India and join with their kin. In some cases this might alleviate ethnic conflicts involving those groups, but they might also use neighboring countries as bases from which to continue conflicts with the Chinese state.

Heightened stress on populations in the host countries could result in conflict between Chinese migrants and locals. China already witnessed similar episodes during riots in Indonesia, where members of the well-established ethnic Chinese communities were attacked and women raped. More recent Chinese migrants may find themselves in even more precarious positions vis-à-vis hostile local groups. The Indonesian violence caused a furor in Beijing, and China can be expected to react harshly to future anti-Chinese violence in neighboring countries.

Siberia and the Russian Far East. The numbers of Chinese economic migrants crossing the border into the Russian Far East are already considerable. As yet, most of them move back and forth over the border rather than settling, but sustained climatic pressure could change that. Pressure from desertification in China's Northeast could increase Chinese migration into the Amur River valley and Russia's Maritime Provinces—areas where ethnic Russian demographics are in decline. The potential exists for the Russian Far East to become demographically Chinese, a process that will likely be accelerated by climate change. This shift could create serious tension between Russia and China, eroding the recent improvements in bilateral relations between the two powers.

Mongolia. Mongolia is wary of large inflows of Chinese as the Mongolian construction and mining industries depend on Chinese migrant labor. Native Mongolians are not interested in industrial jobs. They either subsist as herders on the steppe or work in the service sector in the capital. Mongolia recently suffered two years of severe drought, which generated tension between Mongolians and Chinese as herders were forced to seek other employment. Climate change is likely to inflict more drought and large-scale desertification on the Mongolian steppe, which could leave a large unemployed Mongolian workforce competing with Chinese migrants. Ethnic conflict in Mongolia could spread to China's own Mongolian population, which is likely to face particularly acute stress from climate change.

Immigration and Refugees. Increased immigration and refugee flows into China as a result of climate change are distinct possibilities, depending on the severity of climate change impacts on other countries along China's periphery. Immigration is not likely to significantly stress China's capacity, given that the relative numbers involved would be miniscule compared to the likely domestic migration within China. China is likely to try to keep refugee and immigrant groups geographically contained. China has pursued a similar policy with the significant refugee flows it has received from North Korea, not only environmental refugees but also political and economic ones. North Korea's capacity to cope with climatic pressures is very questionable given the ruinous state of its economy. As has been the case with past humanitarian disasters such as famines, a climate change-induced catastrophe in North Korea would by default spill over into China's Northeast. Climatic pressures from desertification and water scarcity could also create refugee flows from China's arid neighbors such as Mongolia and the Central Asian republics. A worrisome unknown for China's government is the extent to which refugees would join with their ethnic kin within China, potentially worsening internal ethnic instability and conflict.

China might also become an attractive destination for migrants from tropical parts of Asia that may receive more severe climate change effects, particularly if China copes relatively well with climate change. Migration from Southeast Asia could assume proportions similar to that between Latin America and the United States. If China fares markedly better than countries in Southeast Asia it will likely have an incentive to bolster these countries' adaptive capacities and promote regional cooperation in order to forestall large-scale migration.

Overall Foreign Policy Implications

China's rapid rise and apparent ambivalence toward many of the values and institutions of the existing global order has raised concerns that China is a revisionist power that will seek to overturn the international system. The situation does not appear to be that clear cut. China is ascendant toward a leadership position in the international system. Chinese leaders see the present moment as one in which China should become the global hegemon, succeeding the United States just as the US replaced Britain as the global hegemon after World War I. As China assumes a leadership role in the international system, it will need to collaborate with other powers such as the United States, Europe, and Japan in managing global crises associated with climate change.

China's approach to such a leadership role is less clear. China's leaders perceive their country as unique, a "G-1." Since the de facto demise of revolutionary Maoist ideology, they do not identify themselves as the standard-bearer of an international movement or ideology such as democracy or Communism. Instead, they see China as a civilization unto itself, a global moral pole whose values and achievements others can emulate but not join. China does not necessarily view the international system as constraining it, nor does it necessarily seek to replace existing institutions with its own.

China has on the whole avoided either integrating with or undermining international institutions. This is not to say that China has treated such institutions with disregard. In fact, it has been willing to join international institutions and agreements, as long as doing so does not subordinate it to international authority. On the other hand, China is not willing to be the dominant power in institutions it joins, as long as no one else is either. For that reason it has avoided institutions the United States exerts a decisive influence over, such as APEC, while embracing ASEAN +3 and

the United Nations, as well as aid from the IMF and World Bank. China played an instrumental role in creating an international security organization, the Shanghai Cooperation Organization (SCO). Its approach has been pragmatic and cynical, using international institutions and agreements that best serve China's interests.

China's overall approach toward international institutions is an important indicator of how it will approach international cooperation on climate change mitigation. Its posture suggests a lack of fundamental commitment to most international institutions and agreements except in an instrumental way. This reflects a sense that international regimes such as the Framework Convention on Climate Change (FCCC) are not always designed in ways that reflect its interests. Similarly, China accepts international standards on environmental degradation in the same way that it accepts human and labor rights—formally but not substantively. For example, China sits on the board of the International Labor Organization, even though it has no intention of allowing free labor unions.

In the final analysis, China's approach suggests that their strict compliance with international agreements cannot be counted on if the terms of the agreement begin to significantly detract from state interests and priorities. While violating a formal treaty obligation would put Beijing in a difficult position, China's leading global position and economic clout should insulate it from most adverse consequences. Given China's leverage in finance and other arenas, it would be very difficult for the United States to force Beijing to adhere to a climate agreement if Chinese leaders decided to abandon it.

China's Foreign Policy Perspectives on Climate Change

China strongly believes in equitable responsibility and therefore expects countries that are primarily responsible for greenhouse gas emissions to bear the greater share of the costs for mitigating climate change. Chinese leaders contend that the US and other industrialized democracies hypocritically export their polluting industries, while China is unfairly used as a scapegoat. At the same time, China realizes that regardless of who is principally responsible, climate change will have significantly negative consequences for China resulting in the need for implementing mitigation and adaption programs.

Climate change is likely to increase China's overall dependence on international sources of energy, food, and technology. China remains wary of international markets that it cannot control, preferring outright control of resources. As its external dependence increases, it will most likely seek to establish a growing forward presence in the world. This will likely take the form principally of Chinese companies purchasing critical resources in foreign countries. China probably will pursue greater cooperation with foreign partners and engagement in setting the terms of international trade. In addition, if faced with insecure sources or supply lines, China may see a need to establish diplomatic or military footholds in regions of interest. These processes are already under way in many areas of the globe, including Africa and Latin America.

China's leaders approach international cooperation on climate change and other issues in terms of how it will benefit their interests. International cooperation is not perceived as good in itself. Nevertheless, the need for international support and cooperation in addressing climate change mitigation will ideally put a growing premium on maintaining good relations with neighboring countries and access to Western resources, technology, ideas, information, and expertise. This has already increased Western influence on Chinese economic planning through the carrot and

stick approach—project funding on the one hand and pressure to meet international standards on the other.

China's International Climate Change Challenges

Global Migration. By 2030 major parts of the world, especially in tropical and subtropical regions, will be facing more serious climate change challenges and possibly serious natural disasters and consequently political instability and social disorder. Like the developed countries, China may become an appealing destination for environmental migrants and refugees seeking relative order and stability. China is unlikely to accede to large-scale immigration given its cultural traditions and the massive internal migration the state and society will already have to contend with. Under these circumstances, China will find itself with two major policy imperatives—to take action to reduce and divert the international flow of climate change refugees, and to collaborate with the developed countries to intervene on behalf of undeveloped or underdeveloped nations struggling to cope with both poverty and climate change repercussions.

On the other hand, the effects of climate change are likely to result in emigration of Chinese overseas. As segments of Chinese society become increasingly wealthy, they will look for more environmentally attractive living conditions outside of China. It is likely that middle-class and wealthy Chinese will expand their overseas property investments and emigration. Should this reach an unprecedented scale, an anti-Chinese backlash may develop overseas, raising the salience of emigration to China's foreign policy.

International Pressure. Although China portrays itself as a champion of the developing world, its interests diverge from those of the G-77 countries as it rapidly becomes wealthier and more industrialized. This divergence is especially relevant to climate change issues. China faces growing international pressure due to its status as a leading greenhouse gas emitter and polluter, yet the G-77 countries lack leverage with China as they are desperately in need of Chinese investments. China responds aggressively to public criticism and smaller countries may suffer serious economic consequences if they do not seek cover in a multilateral forum.

International rhetorical pressure, while in many instances are easy for China's leaders to dismiss, carries a reputational impact. China perceives itself as a global moral pole and its leaders seek approval for their environmental policies. The Chinese promote their efforts in solar panel installation for hot water heating. They highlight their re-forestation projects but do not want to be held accountable for cutting down forests in the Russian Far East, Burma, Laos, Cambodia, and Indonesia. They show their commitment to becoming a world leader in building electric cars but do not want to be criticized for erecting polluting coal power plants while choosing not to lower emissions by using available technologies. They see themselves as a late-comer to the oil business with their need to meet China's energy crisis by buying oil from countries such as Burma, Iran, Sudan, and Angola, yet are demonized for acting in the sake of survival.

Countries may impose more concrete forms of pressure on China, such as trade sanctions, to push the country towards compliance with climate change mitigation measures. Although the standard model for trade negotiations is to exclude these types of externalities, climate change affects the trading system in a number of ways, such as the cost of production. WTO rules reduce the utility of trade sanctions as a lever to push climate change mitigation, but some options may include a ten 10 percent cost premium for carbon or the inclusion of climate change impact statements in all bilateral trade interactions.

Tariffs also could be levied on emissions-intensive industries. The specific domestic context associated with such tariffs would need to be considered such as a US tariff on Chinese steel production. Big steel mills such as Baoshan Steel operate through set-price contracts which would be insulated from a new tariff, conversely smaller mills which have to buy on the spot market would be affected. As a result, with a tariff in place Baoshan Steel would surpass its domestic competitors. Unintended consequences of this sort could render an ill-considered tariff counterproductive.

US Diplomatic Approaches

The US Government might use a number of approaches to effectively engage and convince China on climate change mitigation. It might be more fruitful to package these as part of a larger deal on improved US-China relations rather than focusing exclusively on climate change. In addition, several of these approaches depend on the US Government taking China's interests and perspectives more firmly into account. Increased sensitivity on Washington's part will not persuade Beijing to believe that the United States is concerned with China's interests. On the other hand, if Washington projects that it understands China's position, it is in a better posture to advocate climate change mitigation as a win/win scenario.

Proactive Confidence Building Measures. China's attitude toward the United States is one of deep distrust. The Chinese polity is suspicious that the US will undermine Chinese growth and undercut Chinese exports, which is seen by the Chinese Government as crucial for job creation and regime stability. Chinese leaders' suspicion is reinforced by such cases as the US Congress blocking the legal purchase by a Chinese State Owned Enterprise (SOE) of American oil assets in Asia. China's mistrust of US government motives is a major roadblock to arriving at a climate change agreement.

An effective climate change mitigation agreement between China and the United States would incorporate substantial compliance verification and trust-building mechanisms, akin to the Cold War-era confidence building measures between the United States and Soviet Union. In part, this could be accomplished through technical means, such as a system of regularized exchanges of inspections, technical monitoring, and remote sensing verification by over-flights or space-based platforms. Space-based platforms are also technically important for monitoring climate change, and China could be given shared access to such data. Such increases in mutual transparency would obviously be highly sensitive. Each country would most likely have to accept sensors and inspectors on its territory that would provide visibility into critical elements of its economy such as power generation.

In addition, the United States could be proactive in instituting emissions cuts and other climate change mitigation measures. This would concretely demonstrate US sincerity, particularly if taking action first placed the United States at a competitive disadvantage. Although this approach could convince China to reciprocate, the United States should be mindful that what China would offer in return is politically acceptable in Beijing. China is not likely to take action that would significantly constrain its growth in return for the United States taking the first.

Sensitivity to China's Development Goals. Although neither China nor the United States will compromise growth for climate change mitigation there is room to develop common ground. China's development goals are not as divergent from climate change mitigation goals as was the case a few years ago. China's plan to shift from an export-led heavy industrial development model to one based on services and domestic consumption will reduce emissions and provide

opportunities for sustainable practices and other climate change mitigation measures. China's projected new growth model is fairly constructive from an energy and climate standpoint. China's views on climate change are conditioned by where China wants to be in 5 or 10 years, not so much where it is now. The US Government's assumption that present-day conditions are a baseline for action is not compatible with China's development plans. An understanding of China's planned trajectory will prevent the United States from over-compensating China for changes in behavior.

Framing the debate in terms of carbon emissions is not optimal in terms of receiving Chinese policy buy-in. Even if emission controls succeed in the long term, Chinese emissions will grow considerably in the next decade. In the near-term, China can do little to address emissions while at the same time maintaining its growth, so emissions-based arguments are perceived by Beijing as unfair persecution. China does not feel it bears equal responsibility for emissions with the developed countries. China was responsible for eight percent of emissions in the last century, while the United States was responsible for 30 percent. In addition, some of the emissions control measures being advocated, such as carbon collection and storage cannot be proven and have no economic co-benefits, possibly even worsening energy security. Greater emphasis on energy efficiency measures offers a pathway for China to decouple carbon emissions from economic growth and would make the emissions reduction debate more palatable in Beijing. China wishes to avoid being singled out as the world's largest source of greenhouse gasses and the origin of most of the world's most recent carbon emissions. Chinese leaders do not want to be exposed for lacking the state institutions needed to deal with climate change. Losing face on such issues is not likely to put China in a receptive frame of mind.

Technology Transfers and Scientific Cooperation. Chinese research and development (R&D) and industrial development policies are increasingly focused on energy and environmental issues. The prospects of China building a more synthetic environment in response to climate change offers interesting possibilities for international cooperation in directing the project toward a relatively less energy and resource intensive trajectory. The expanding capabilities of China's R&D system will likely establish it as a leader in new climate change mitigation technologies in the longer term. In the near term it will need to acquire technology overseas. During negotiations for improved international cooperation on climate change, China is likely to press its case for the industrialized countries to be more forthcoming with technology and assistance. While roadblocks such as dual-use technology export provisions make technology transfers at the government level unlikely, much of the sharing of energy saving technology will occur through commercial channels.

Opportunities for mutually beneficial scientific and technological cooperation between China and other countries in the world undoubtedly will arise. The United States and other developed countries have the technology, but China has the low cost manufacturing capability that will be necessary to produce green technology en masse. A case can be made for a cooperative approach where an American company provides designs to be produced by a Chinese company and sold to Bangladesh. Climate change mitigation can be sold to China as a new green export industry. The opportunity to participate in green technology rollout gives China a substantial profit incentive to come to a climate change mitigation agreement. This will have to be weighed against the commercialization of technologies that might provide the most impact if provided to poor recipients as aid.

Building Bridges. The panelists observed the United States should make a major effort to build cooperative academic, professional, business, and government links with Chinese counterparts involved in climate change-related activity at all levels. The best channels through which to build common understanding between US and Chinese leadership are to cultivate links with a broad spectrum of actors within the Chinese state and society. Their views will percolate up to the leadership, who will far more readily accept ideas coming from Chinese subordinates and advisors than from US negotiators. Attention at the elite level in China is a scarce resource and the more avenues the US government employs to send its message to China's leadership, the better its chances of being assimilated.

Engaging with officials and academics, particularly in China's robust government-funded think tank sector, would facilitate dissemination of American technical and scientific perspectives on the impacts of climate change and the optimal solutions. As part of this engagement, it would be worthwhile to pay attention to the terms of the evolving Chinese discourse on "Scientific Development." Relevant US Congressional committees should be encouraged to link with the Environment and Natural Resources Protection Committee of China's National People's Congress. Additionally, panelists recommended the Executive Branch seek contacts with members of China's State Councils' Inter-Agency Joint Meetings on Environment; with the Leadership Group on Climate Change, which is chaired by the Prime Minister; and with the Metallurgy Ministry and the Energy Ministry which, along with the State Planning Commission, tend to be allied with energy and heavy industry interests who oppose environmental action. Panelists observed that US mayors that are actively involved in environmental issues should engage in partnership with sister cities in China that face serious pollution issues. Bearing in mind that leadership succession is determined far in advance in China's political system, engaging directly with China's heir could be fruitful, although this would be a very sensitive move in terms of his domestic position with the other regime leadership and should therefore be handled privately and discreetly.

This broad-based engagement could also include military-to-military ties. Despite periodic tense incidences, the United States Department of Defense has constructively looked for ways to work with the Chinese. Encouraging communication reduces the risk of an inadvertent conflict as in the recent cooperation against Somali piracy. Climate change-related humanitarian missions present collaborative opportunities. Humanitarian response to climate change is one of the best examples of a recurrent, discrete problem on which the United States and Chinese armed forces can work well together. For example, the People's Liberation Army Navy (PLAN) and the US Navy could jointly respond to a severe storm, flood, or drought in Southeast Asia. China's economic and military growth means that it will increasingly have the wherewithal to contribute significantly in such instances.

According to the panel, the United States should be careful to keep engagement with elements of civil society on climate change issues transparent to the Chinese Government. There may be particular sensitivity to American approaches to Chinese NGOs. To preserve the freedom of action and effectiveness of Chinese NGO partners, they should only be contacted by US NGOs, not the US Government, and then only with the awareness of the Chinese Government. Such precautions need not apply across the board, but keeping a respectful degree of distance may ease some of China's inherent suspicion of American meddling in its domestic affairs.

Sensitivity to Domestic Constituencies. Despite the superficially monolithic qualities of China's party-state, China's international actions do not always reflect its overall national interests.

Actors such as major corporations—including state-owned enterprises—and well-connected families have shown the capacity to successfully hijack state policy for their own profit. China's oil involvement with the controversial regime in Sudan is a prime example. Even when faced with considerable international pressure and awareness that China was not receiving commensurate benefits from Sudanese oil, the party-state proved unable or unwilling to change its policies. International pressure on climate change issues could run into similar roadblocks if powerful domestic interests in China stand to lose out, even if compliance is in China's overall interests.

Panelists observed the domestic constituencies need to be taken into account when the United States engages with China, and vice versa. Even in China's opaque authoritarian system, climate change mitigation proposals will have to survive an extensive ratification process. Attention to the actors and institutions that will be involved in that process would help tailor negotiations to produce proposals with optimal chances of receiving approval. The US can encourage cooperation and build confidence by explaining the need for China's assistance in selling an agreement to the American people. For example, if China would be willing to agree to limits on steel and coal, it would be easier to pass an agreement in the United States. In return for China's assistance, the US administration could offer to help the Chinese leadership sell the agreement to other constituencies within the party state. This reinforces the need for China and the US to view each other's constituencies as their own.

Multilateral Discussions. A multilateral approach may be the best avenue for bilateral cooperation between Beijing and Washington. While on some level, China's leadership may prefer a "G-2" approach to bilateral cooperation with the United States, as proof that China is also a superpower, on balance China is not comfortable dealing with the United States bilaterally. China perceives the US has ulterior motives and aims to subvert China's authoritarian power and re-establish the United States' global presence as the world's indispensable power. Alternatively, China prefers to have third-parties present, even if the negotiation is de facto bilateral.

The presence of a third party in negotiations is more important than the third party's particular identity. China would be more comfortable if any major autonomous actor was included in the discussions, such as Japan or South Korea. The Chinese particularly favor the other BRIC countries (Brazil, Russia, and India). Larger multilateral forums where China will feel it has allies and regional groupings such as ASEAN or the EU would also be suitable. The US could cooperate with the EU in its Clean Development Mechanism projects with China on emissions controls. Cooperative efforts are also possible via broader international bodies such as the UN's Intergovernmental Panel on Climate Change, the World Bank, or the Asian Development Bank. In sum, almost any forum or multilateral discussion where Beijing would feel less threatened by the weight of the United States would produce better results than strictly bilateral discussions.

The Copenhagen Negotiations

Taking into account China's perspective, the Copenhagen negotiations will most likely result in an agreement expecting the large emerging economies to make commitments—automobile standards, technical improvements in particular industries—that lay the groundwork necessary to put in place *future* mitigation measures without harming their economic growth. In lieu of emission caps for China—which no one really expects—a more reasonable alternative would be to develop an external international framework under a post-Kyoto agreement that would incentivize China moving away from emissions-intensive industries while compensating

economically in other ways. Such a framework would allow China to comply with an international climate agreement while still fulfilling its macroeconomic goals.

Take India Into Account. Panelists recommended the US Government negotiating position take into account the unstable and complex triangular relationship between the United States, China, and India. Effective climate change mitigation, as well as US strategic interests, require careful management of relations with both of these rising Asian giants. India and China are long-term strategic competitors, including climate change-related issues such as access to the Himalayan water. Either country would perceive a bilateral American approach to the other as a major slight and an indicator of the United States' long-term strategic intentions. On the other hand, India and China have parallel positions vis-à-vis the international climate change negotiations. Both support per capita approaches to measuring emissions, stress the importance of maintaining growth and believe that developed countries must bear the lion's share of climate change mitigation measures. They are likely to diverge on the climate issue as China's growth brings its emissions profile more into line with the developed countries and as climatic disputes between the two powers become more salient. An effective agreement at Copenhagen will require the assent of both India and China.

Avoid Binary Distinctions. To further facilitate Chinese Government cooperation, panelists further recommended the US avoid the "us versus them" binary term. China's ambiguous status relative to the developing and developed countries does not lend itself to binary categorization. Leading Chinese economist, Hu Angang, proposed in April 2009 that the binary "developed" and "developing" categories used in the United Nations Framework Convention on Climate Change (FCCC) be replaced at Copenhagen by four categories along a spectrum based on the Human Development Index.

Similarly, Chinese leaders do not imagine the Chinese state as a flawed authoritarian regime competing with a democratic United States. Ruling groups in Beijing do not identify with authoritarian regimes in Moscow, Pyongyang or Rangoon. Instead, they see China as unique—a success such as the world has never known. According to the panelists, their focus should be on shared yet differentiated responsibilities to the planet, with China recognized as one of the global leaders in solving the world's problems.

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